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

B DECAY MODES

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

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

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

	Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Semileptonic and leptonic modes			
Γ_1	$B \rightarrow e^+ \nu_e$ anything	[a]	(10.70 ± 0.28) %	
Γ_2	$B \rightarrow \overline{p} e^+ \nu_e$ anything		< 1.6 × 10^{-3}	CL=90%
Γ_3	$B \rightarrow \mu^+ \nu_\mu$ anything	[a]		
Γ_4	$B \rightarrow \ell^+ \nu_\ell$ anything	[a,b]	(10.64 ± 0.23) %	
Γ_5	$B \rightarrow D^- \ell^+ \nu_\ell$ anything	[b]	(2.8 ± 0.9) %	
Γ_6	$B \rightarrow \overline{D}^0 \ell^+ \nu_\ell$ anything	[b]	(7.1 ± 1.4) %	
Γ_7	$B \rightarrow D^{*-} \ell^+ \nu_\ell$ anything			
Γ_8	$B \rightarrow D^{*0} \ell^+ \nu_\ell$ anything			
Γ_9	$B \rightarrow \overline{D}^{**} \ell^+ \nu_\ell$	[b,c]	(2.7 ± 0.7) %	
Γ_{10}	$B \rightarrow \overline{D}_1(2420) \ell^+ \nu_\ell$ anything		(7.4 ± 1.6) × 10^{-3}	
Γ_{11}	$B \rightarrow D \pi \ell^+ \nu_\ell$ anything + $D^* \pi \ell^+ \nu_\ell$ anything		(2.6 ± 0.5) %	S=1.5
Γ_{12}	$B \rightarrow D \pi \ell^+ \nu_\ell$ anything		(1.5 ± 0.6) %	
Γ_{13}	$B \rightarrow D^* \pi \ell^+ \nu_\ell$ anything		(1.9 ± 0.4) %	
Γ_{14}	$B \rightarrow \overline{D}_2^*(2460) \ell^+ \nu_\ell$ anything		< 6.5 × 10^{-3}	CL=95%

Γ_{15}	$B \to D^{*-}\pi^+\ell^+\nu_\ell$ anything		(1.00 ± 0.34) %	
Γ_{16}	$B \to D_s^-\ell^+\nu_\ell$ anything	[b]	< 9 × 10^{-3}	CL=90%
Γ_{17}	$B \to D_s^-\ell^+\nu_\ell K^+$ anything	[b]	< 6 × 10^{-3}	CL=90%
Γ_{18}	$B \to D_s^-\ell^+\nu_\ell K^0$ anything	[b]	< 9 × 10^{-3}	CL=90%
Γ_{19}	$B \to \ell^+\nu_\ell$ noncharmed	[b]		
Γ_{20}	$B \to K^+\ell^+\nu_\ell$ anything	[b]	(6.1 ± 0.5) %	
Γ_{21}	$B \to K^-\ell^+\nu_\ell$ anything	[b]	(10 ± 4) × 10^{-3}	
Γ_{22}	$B \to K^0/\overline{K}^0\ell^+\nu_\ell$ anything	[b]	(4.5 ± 0.5) %	

D, *D**, or *D*$_s$ modes

Γ_{23}	$B \to D^\pm$ anything		(24.5 ± 2.1) %	
Γ_{24}	$B \to D^0/\overline{D}^0$ anything		(64.0 ± 2.9) %	S=1.1
Γ_{25}	$B \to D^*(2010)^\pm$ anything		(22.5 ± 1.5) %	
Γ_{26}	$B \to D^*(2007)^0$ anything		(26.0 ± 2.7) %	
Γ_{27}	$B \to D_s^\pm$ anything	[d]	(10.5 ± 2.6) %	
Γ_{28}	$B \to D_s^{*\pm}$ anything		(7.9 ± 2.2) %	
Γ_{29}	$B \to D_s^{*\pm}\overline{D}^{(*)}$		(4.2 ± 1.2) %	
Γ_{30}	$B \to D^{(*)}\overline{D}^{(*)}K^0 + D^{(*)}\overline{D}^{(*)}K^\pm$	[d,e]	(7.1 $^{+2.7}_{-1.7}$) %	
Γ_{31}	$b \to c\overline{c}s$		(22 ± 4) %	
Γ_{32}	$B \to D_s{}^{(*)}\overline{D}^{(*)}$	[d,e]	(4.9 ± 1.2) %	
Γ_{33}	$B \to D^* D^*(2010)^\pm$	[d]	< 5.9 × 10^{-3}	CL=90%
Γ_{34}	$B \to D D^*(2010)^\pm + D^* D^\pm$	[d]	< 5.5 × 10^{-3}	CL=90%
Γ_{35}	$B \to D D^\pm$	[d]	< 3.1 × 10^{-3}	CL=90%
Γ_{36}	$B \to D_s{}^{(*)\pm}\overline{D}^{(*)}X(n\pi^\pm)$	[d,e]	(9 $^{+5}_{-4}$) %	
Γ_{37}	$B \to D^*(2010)\gamma$		< 1.1 × 10^{-3}	CL=90%
Γ_{38}	$B \to D_s^+\pi^-,\ D_s^{*+}\pi^-,\ D_s^+\rho^-,\ D_s^{*+}\rho^-,\ D_s^+\pi^0,\ D_s^{*+}\pi^0,\ D_s^+\eta,\ D_s^{*+}\eta,\ D_s^+\rho^0,\ D_s^{*+}\rho^0,\ D_s^+\omega,\ D_s^{*+}\omega$	[d]	< 5 × 10^{-4}	CL=90%
Γ_{39}	$B \to D_{s1}(2536)^+$ anything		< 9.5 × 10^{-3}	CL=90%

Charmonium modes

Γ_{40}	$B \to J/\psi(1S)$ anything		(1.090 ± 0.035) %	S=1.1
Γ_{41}	$B \to J/\psi(1S)$(direct) anything		(7.6 ± 0.4) × 10^{-3}	
Γ_{42}	$B \to \psi(2S)$ anything		(3.10 ± 0.24) × 10^{-3}	
Γ_{43}	$B \to \chi_{c1}(1P)$ anything		(3.62 ± 0.27) × 10^{-3}	
Γ_{44}	$B \to \chi_{c1}(1P)$(direct) anything		(3.34 ± 0.27) × 10^{-3}	

Γ_{45}	$B \to \chi_{c2}(1P)$ anything		$(1.3 \pm 0.4) \times 10^{-3}$	S=1.9
Γ_{46}	$B \to \chi_{c2}(1P)$(direct) anything		$(1.65 \pm 0.31) \times 10^{-3}$	
Γ_{47}	$B \to \eta_c(1S)$ anything		$< 9 \times 10^{-3}$	CL=90%

K or K^* modes

Γ_{48}	$B \to K^{\pm}$ anything	[d]	(78.9 ± 2.5) %	
Γ_{49}	$B \to K^{+}$ anything		(66 ± 5) %	
Γ_{50}	$B \to K^{-}$ anything		(13 ± 4) %	
Γ_{51}	$B \to K^0 / \overline{K}^0$ anything	[d]	(64 ± 4) %	
Γ_{52}	$B \to K^*(892)^{\pm}$ anything		(18 ± 6) %	
Γ_{53}	$B \to K^*(892)^0 / \overline{K}^*(892)^0$ anything	[d]	(14.6 ± 2.6) %	
Γ_{54}	$B \to K^*(892)\gamma$		$(4.2 \pm 0.6) \times 10^{-5}$	
Γ_{55}	$B \to K_1(1400)\gamma$		$< 1.27 \times 10^{-4}$	CL=90%
Γ_{56}	$B \to K_2^*(1430)\gamma$		$(1.7 {}^{+0.6}_{-0.5}) \times 10^{-5}$	
Γ_{57}	$B \to K_2(1770)\gamma$		$< 1.2 \times 10^{-3}$	CL=90%
Γ_{58}	$B \to K_3^*(1780)\gamma$		$< 3.0 \times 10^{-3}$	CL=90%
Γ_{59}	$B \to K_4^*(2045)\gamma$		$< 1.0 \times 10^{-3}$	CL=90%
Γ_{60}	$B \to \eta'(958) K$		$(8.3 \pm 1.1) \times 10^{-5}$	
Γ_{61}	$B \to \eta'(958) K^*(892)$		$< 2.2 \times 10^{-5}$	CL=90%
Γ_{62}	$B \to \eta K$		$< 5.2 \times 10^{-6}$	CL=90%
Γ_{63}	$B \to \eta K^*(892)$		$(1.8 \pm 0.5) \times 10^{-5}$	
Γ_{64}	$B \to \overline{b} \to \overline{s}\gamma$		$(3.3 \pm 0.4) \times 10^{-4}$	
Γ_{65}	$B \to \overline{b} \to \overline{s}$ gluon		< 6.8 %	CL=90%
Γ_{66}	$B \to \eta$ anything		$< 4.4 \times 10^{-4}$	CL=90%
Γ_{67}	$B \to \eta'$ anything		$(6.2 {}^{+2.1}_{-2.6}) \times 10^{-4}$	

Light unflavored meson modes

Γ_{68}	$B \to \rho\gamma$		$< 1.4 \times 10^{-5}$	CL=90%
Γ_{69}	$B \to \pi^{\pm}$ anything	[d,f]	(358 ± 7) %	
Γ_{70}	$B \to \pi^0$ anything		(235 ± 11) %	
Γ_{71}	$B \to \eta$ anything		(17.6 ± 1.6) %	
Γ_{72}	$B \to \rho^0$ anything		(21 ± 5) %	
Γ_{73}	$B \to \omega$ anything		< 81 %	CL=90%
Γ_{74}	$B \to \phi$ anything		(3.5 ± 0.7) %	S=1.8
Γ_{75}	$B \to \phi K^*(892)$		$< 2.2 \times 10^{-5}$	CL=90%

Baryon modes

Γ_{76}	$B \to \Lambda_c^{\pm}$ anything		(6.4 ± 1.1) %	
Γ_{77}	$B \to \Lambda_c^{+}$ anything			
Γ_{78}	$B \to \overline{\Lambda}_c^{-}$ anything			
Γ_{79}	$B \to \overline{\Lambda}_c^{-} e^{+}$ anything		$< 3.2 \times 10^{-3}$	CL=90%
Γ_{80}	$B \to \overline{\Lambda}_c^{-} p$ anything		(3.6 ± 0.7) %	

Γ_{81}	$B \to \overline{\Lambda}_c^- p e^+ \nu_e$			$< 1.5 \times 10^{-3}$ CL=90%
Γ_{82}	$B \to \overline{\Sigma}_c^{--}$ anything			$(4.2 \pm 2.4) \times 10^{-3}$
Γ_{83}	$B \to \overline{\Sigma}_c^-$ anything			$< 9.6 \times 10^{-3}$ CL=90%
Γ_{84}	$B \to \overline{\Sigma}_c^0$ anything			$(4.6 \pm 2.4) \times 10^{-3}$
Γ_{85}	$B \to \overline{\Sigma}_c^0 N (N = p$ or $n)$			$< 1.5 \times 10^{-3}$ CL=90%
Γ_{86}	$B \to \Xi_c^0$ anything $\times$ B($\Xi_c^0 \to \Xi^- \pi^+$)			$(1.4 \pm 0.5) \times 10^{-4}$
Γ_{87}	$B \to \Xi_c^+$ anything $\times$ B($\Xi_c^+ \to \Xi^- \pi^+ \pi^+$)			$(4.5 {+1.3 \atop -1.2}) \times 10^{-4}$
Γ_{88}	$B \to p/\overline{p}$ anything		[d]	(8.0 ± 0.4) %
Γ_{89}	$B \to p/\overline{p}$(direct) anything		[d]	(5.5 ± 0.5) %
Γ_{90}	$B \to \Lambda/\overline{\Lambda}$ anything		[d]	(4.0 ± 0.5) %
Γ_{91}	$B \to \Lambda$ anything			
Γ_{92}	$B \to \overline{\Lambda}$ anything			
Γ_{93}	$B \to \Xi^-/\overline{\Xi}^+$ anything		[d]	$(2.7 \pm 0.6) \times 10^{-3}$
Γ_{94}	$B \to$ baryons anything			(6.8 ± 0.6) %
Γ_{95}	$B \to p\overline{p}$ anything			(2.47 ± 0.23) %
Γ_{96}	$B \to \Lambda\overline{p}/\overline{\Lambda}p$ anything		[d]	(2.5 ± 0.4) %
Γ_{97}	$B \to \Lambda\overline{\Lambda}$ anything			$< 5 \times 10^{-3}$ CL=90%

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

Γ_{98}	$B \to s e^+ e^-$	*B1*		$(5.0 \pm 2.6) \times 10^{-6}$
Γ_{99}	$B \to s \mu^+ \mu^-$	*B1*		$(7.9 {+3.0 \atop -2.6}) \times 10^{-6}$
Γ_{100}	$B \to s \ell^+ \ell^-$	*B1*	[b]	$(6.1 {+2.0 \atop -1.8}) \times 10^{-6}$
Γ_{101}	$B \to K e^+ e^-$	*B1*		$< 1.3 \times 10^{-6}$ CL=90%
Γ_{102}	$B \to K^*(892) e^+ e^-$	*B1*		$< 5.6 \times 10^{-6}$ CL=90%
Γ_{103}	$B \to K \mu^+ \mu^-$	*B1*		$(9.9 {+4.2 \atop -3.5}) \times 10^{-7}$
Γ_{104}	$B \to K^*(892) \mu^+ \mu^-$	*B1*		$< 3.1 \times 10^{-6}$ CL=90%
Γ_{105}	$B \to K \ell^+ \ell^-$	*B1*		$(7.5 {+2.6 \atop -2.2}) \times 10^{-7}$
Γ_{106}	$B \to K^*(892) \ell^+ \ell^-$	*B1*		$< 3.1 \times 10^{-6}$ CL=90%
Γ_{107}	$B \to e^\pm \mu^\mp s$	*LF*	[d]	$< 2.2 \times 10^{-5}$ CL=90%
Γ_{108}	$B \to \pi e^\pm \mu^\mp$	*LF*		$< 1.6 \times 10^{-6}$ CL=90%
Γ_{109}	$B \to \rho e^\pm \mu^\mp$	*LF*		$< 3.2 \times 10^{-6}$ CL=90%
Γ_{110}	$B \to K e^\pm \mu^\mp$	*LF*		$< 1.6 \times 10^{-6}$ CL=90%
Γ_{111}	$B \to K^*(892) e^\pm \mu^\mp$	*LF*		$< 6.2 \times 10^{-6}$ CL=90%

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

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

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

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

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

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

$B^{\pm}/B^0$ ADMIXTURE BRANCHING RATIOS

$\Gamma(\ell^+\nu_\ell\,\text{anything})/\Gamma_{\text{total}}$ — Γ_4/Γ

These branching fraction values are model dependent.

"OUR EVALUATION" is an average of the data listed below performed by the Heavy Flavor Averaging Group (HFAG).

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.1070±0.0028 OUR EVALUATION				
0.1064±0.0023 OUR AVERAGE Includes data from the 2 datablocks that follow this one. [0.1038 ± 0.0032 OUR 2002 AVERAGE]				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.108 ±0.002 ±0.0056	[1] HENDERSON	92	CLEO	$e^+e^- \to \Upsilon(4S)$

[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.

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

These branching fraction values are model dependent.

"OUR EVALUATION" is an average of the data listed below performed by the Heavy Flavor Averaging Group (HFAG).

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
The data in this block is included in the average printed for a previous datablock.				
0.1070±0.0028 OUR EVALUATION				
0.1064±0.0023 OUR NEW AVERAGE [0.102 ± 0.004 OUR 2002 AVERAGE]				
0.1087±0.0018±0.0030	[2] AUBERT	03	BABR	$e^+e^- \to \Upsilon(4S)$
0.109 ±0.0012±0.0049	[3] ABE	02Y	BELL	$e^+e^- \to \Upsilon(4S)$
0.1049±0.0017±0.0043	[4] BARISH	96B	CLE2	$e^+e^- \to \Upsilon(4S)$
0.097 ±0.005 ±0.004	[5] ALBRECHT	93H	ARG	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.100 ±0.004 ±0.003	[6] YANAGISAWA	91	CSB2	$e^+e^- \to \Upsilon(4S)$
0.103 ±0.006 ±0.002	[7] ALBRECHT	90H	ARG	$e^+e^- \to \Upsilon(4S)$
0.117 ±0.004 ±0.010	[8] 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	[9] KLOPFEN...	83B	CUSB	Direct *e* at $\Upsilon(4S)$

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

[3] 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.

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

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

[6] 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.

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

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

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

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

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

VALUE	DOCUMENT ID		TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

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

VALUE	DOCUMENT ID		TECN	COMMENT
$0.100 \pm 0.006 \pm 0.002$	[10] ALBRECHT	90H	ARG	$e^+e^- \to \Upsilon(4S)$
$0.108 \pm 0.006 \pm 0.01$	CHEN	84	CLEO	Direct μ at $\Upsilon(4S)$
$0.112 \pm 0.009 \pm 0.01$	LEVMAN	84	CUSB	Direct μ at $\Upsilon(4S)$

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

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

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

$\Gamma(D^-\ell^+\nu_\ell\text{anything})/\Gamma(\ell^+\nu_\ell\text{anything})$ — Γ_5/Γ_4

$\ell = e$ or μ.

VALUE	DOCUMENT ID		TECN	COMMENT
$0.26 \pm 0.07 \pm 0.04$	[11] FULTON	91	CLEO	$e^+e^- \to \Upsilon(4S)$

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

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

$\ell = e$ or μ.

VALUE	DOCUMENT ID		TECN	COMMENT
$0.67 \pm 0.09 \pm 0.10$	[12] FULTON	91	CLEO	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(D^{*-}\ell^+\nu_\ell \text{anything})/\Gamma_{total}$ — Γ_7/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.6\pm0.3\pm0.1$	[13] BARISH	95	CLE2	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(D^{*0}\ell^+\nu_\ell \text{anything})/\Gamma_{total}$ — Γ_8/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.6\pm0.6\pm0.1$	[14] BARISH	95	CLE2	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\overline{D}^{**}\ell^+\nu_\ell)/\Gamma_{total}$ — Γ_9/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. $\ell = e$ or μ, not sum over e and μ modes.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$0.027\pm0.005\pm0.005$		63	[15] ALBRECHT	93	ARG	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.028	95		[16] BARISH	95	CLE2	$e^+e^- \to \Upsilon(4S)$

[15] 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 $B(D^{*+} \to D^0\pi^+) = 68.1\%$, $B(D^0 \to K^-\pi^+) = 3.65\%$, $B(D^0 \to K^-\pi^+\pi^-\pi^+) = 7.5\%$. We have taken their average e and μ value.

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.0074 ± 0.0016	[17] BUSKULIC	97B	ALEP	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	[18] BUSKULIC	95B	ALEP	Repl. by BUSKULIC 97B

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

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.026 ± 0.005 OUR AVERAGE	Error includes scale factor of 1.5.			
$0.0340\pm0.0052\pm0.0032$	[19] ABREU	00R	DLPH	$e^+e^- \to Z$
$0.0226\pm0.0029\pm0.0033$	[20] BUSKULIC	97B	ALEP	$e^+e^- \to Z$

[19] 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.

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

$\Gamma(D\pi\ell^+\nu_\ell\,\text{anything})/\Gamma_{\text{total}}$ — Γ_{12}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.0154±0.0061	ABREU	00R	DLPH	$e^+e^- \to Z$

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.0186±0.0038	ABREU	00R	DLPH	$e^+e^- \to Z$

$\Gamma(\overline{D}_2^*(2460)\ell^+\nu_\ell\,\text{anything})/\Gamma_{\text{total}}$ — Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0065	95	[21] BUSKULIC	97B	ALEP	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen		[22] BUSKULIC	95B	ALEP	$e^+e^- \to Z$

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

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

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

Includes resonant and nonresonant contributions.

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
10.0±2.7±2.1	[23] BUSKULIC	95B	ALEP	$e^+e^- \to Z$

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

$\Gamma(D_s^-\ell^+\nu_\ell\,\text{anything})/\Gamma_{\text{total}}$ — Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.009	90	[24] ALBRECHT	93E	ARG	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(D_s^-\ell^+\nu_\ell K^+\,\text{anything})/\Gamma_{\text{total}}$ — Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.006	90	[25] ALBRECHT	93E	ARG	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(D_s^- \ell^+ \nu_\ell K^0 \text{anything})/\Gamma_{\text{total}}$ — Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.009	90	[26] ALBRECHT	93E	ARG	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\ell^+ \nu_\ell \text{noncharmed})/\Gamma(\ell^+ \nu_\ell \text{anything})$ — Γ_{19}/Γ_4

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

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
			[27] ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
		107	[28] BARTELT	93B	CLE2	$e^+e^- \to \Upsilon(4S)$
		77	[29] ALBRECHT	91C	ARG	$e^+e^- \to \Upsilon(4S)$
		76	[30] FULTON	90	CLEO	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
		41	[31] ALBRECHT	90	ARG	$e^+e^- \to \Upsilon(4S)$
<0.04	90		[32] BEHRENDS	87	CLEO	$e^+e^- \to \Upsilon(4S)$
<0.04	90		CHEN	84	CLEO	Direct e at $\Upsilon(4S)$
<0.055	90		KLOPFEN...	83B	CUSB	Direct e at $\Upsilon(4S)$

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

[28] BARTELT 93B (CLEO II) measures an excess of $107 \pm 15 \pm 11$ leptons in the lepton momentum interval 2.3–2.6 GeV/c which is attributed to $b \to u\ell\nu_\ell$. This corresponds to a model-dependent partial branching ratio 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.

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

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

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

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

$\Gamma(K^+ \ell^+ \nu_\ell \text{anything})/\Gamma(\ell^+ \nu_\ell \text{anything})$ — Γ_{20}/Γ_4

ℓ denotes e or μ, not the sum.

VALUE	DOCUMENT ID		TECN	COMMENT
0.58 ±0.05 OUR AVERAGE				
0.594±0.021±0.056	ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
0.54 ±0.07 ±0.06	[33] ALAM	87B	CLEO	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(K^- \ell^+ \nu_\ell \text{anything})/\Gamma(\ell^+ \nu_\ell \text{anything})$ — Γ_{21}/Γ_4

ℓ denotes e or μ, not the sum.

VALUE	DOCUMENT ID		TECN	COMMENT
0.092±0.035 OUR AVERAGE				
0.086±0.011±0.044	ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
0.10 ±0.05 ±0.02	[34] ALAM	87B	CLEO	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(K^0/\overline{K}^0 \ell^+ \nu_\ell \text{anything})/\Gamma(\ell^+ \nu_\ell \text{anything})$ — Γ_{22}/Γ_4

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.42 ±0.05 OUR AVERAGE				
0.452±0.038±0.056	[35] ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
0.39 ±0.06 ±0.04	[36] ALAM	87B	CLEO	$e^+e^- \to \Upsilon(4S)$

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

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

$\langle n_c \rangle$

VALUE	DOCUMENT ID		TECN	COMMENT
1.10±0.05	[37] GIBBONS	97B	CLE2	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.98±0.16±0.12	[38] ALAM	87B	CLEO	$e^+e^- \to \Upsilon(4S)$

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

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

$\Gamma(D^\pm \text{anything})/\Gamma_{\text{total}}$ — Γ_{23}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.245±0.021 OUR NEW AVERAGE		[0.239 ± 0.019 OUR 2002 AVERAGE]			
$0.244 \pm 0.013 ^{+0.018}_{-0.017}$		[39] GIBBONS	97B	CLE2	$e^+e^- \to \Upsilon(4S)$
0.26 ±0.04 ±0.02		[40] BORTOLETTO	92	CLEO	$e^+e^- \to \Upsilon(4S)$
0.24 ±0.05 ±0.02		[41] ALBRECHT	91H	ARG	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.21 \pm 0.05 ^{+0.02}_{-0.01}$	20k	[42] BORTOLETTO	87	CLEO	Sup. by BORTOLETTO 92

[39] GIBBONS 97B reports $[B(B \to D^\pm \text{anything}) \times B(D^+ \to K^-\pi^+\pi^+)] = 0.0216 \pm 0.0008 \pm 0.00082$. We divide by our best value $B(D^+ \to K^-\pi^+\pi^+) = (8.8 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[40] BORTOLETTO 92 reports $[B(B \to D^\pm \text{anything}) \times B(D^+ \to K^-\pi^+\pi^+)] = 0.0226 \pm 0.0030 \pm 0.0018$. We divide by our best value $B(D^+ \to K^-\pi^+\pi^+) = (8.8 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[41] ALBRECHT 91H reports $[B(B \to D^\pm \text{anything}) \times B(D^+ \to K^-\pi^+\pi^+)] = 0.0209 \pm 0.0027 \pm 0.0040$. We divide by our best value $B(D^+ \to K^-\pi^+\pi^+) = (8.8 \pm 0.6) \times$

10^{-2}. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[42] BORTOLETTO 87 reports $[B(B \to D^{\pm}\text{anything}) \times B(D^+ \to K^-\pi^+\pi^+)] = 0.019 \pm 0.004 \pm 0.002$. We divide by our best value $B(D^+ \to K^-\pi^+\pi^+) = (8.8 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D^0/\overline{D}^0\,\text{anything})/\Gamma_{\text{total}}$ — Γ_{24}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.640±0.029 OUR NEW AVERAGE Error includes scale factor of 1.1. [0.639 ± 0.030 OUR 2002 AVERAGE Scale factor = 1.1]				
$0.660 \pm 0.025 {}^{+0.016}_{-0.015}$		[43] GIBBONS 97B	CLE2	$e^+e^- \to \Upsilon(4S)$
$0.61 \pm 0.05 \pm 0.01$		[44] BORTOLETTO 92	CLEO	$e^+e^- \to \Upsilon(4S)$
$0.51 \pm 0.08 \pm 0.01$		[45] ALBRECHT 91H	ARG	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.55 \pm 0.07 \pm 0.01$	21k	[46] BORTOLETTO 87	CLEO	$e^+e^- \to \Upsilon(4S)$
$0.63 \pm 0.19 {}^{+0.02}_{-0.01}$		[47] GREEN 83	CLEO	Repl. by BORTOLETTO 87

[43] GIBBONS 97B reports $[B(B \to D^0/\overline{D}^0\text{anything}) \times B(D^0 \to K^-\pi^+)] = 0.0251 \pm 0.0006 \pm 0.00075$. We divide by our best value $B(D^0 \to K^-\pi^+) = (3.80 \pm 0.09) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[44] BORTOLETTO 92 reports $[B(B \to D^0/\overline{D}^0\text{anything}) \times B(D^0 \to K^-\pi^+)] = 0.0233 \pm 0.0012 \pm 0.0014$. We divide by our best value $B(D^0 \to K^-\pi^+) = (3.80 \pm 0.09) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[45] ALBRECHT 91H reports $[B(B \to D^0/\overline{D}^0\text{anything}) \times B(D^0 \to K^-\pi^+)] = 0.0194 \pm 0.0015 \pm 0.0025$. We divide by our best value $B(D^0 \to K^-\pi^+) = (3.80 \pm 0.09) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[46] BORTOLETTO 87 reports $[B(B \to D^0/\overline{D}^0\text{anything}) \times B(D^0 \to K^-\pi^+)] = 0.0210 \pm 0.0015 \pm 0.0021$. We divide by our best value $B(D^0 \to K^-\pi^+) = (3.80 \pm 0.09) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[47] GREEN 83 reports $[B(B \to D^0/\overline{D}^0\text{anything}) \times B(D^0 \to K^-\pi^+)] = 0.024 \pm 0.006 \pm 0.004$. We divide by our best value $B(D^0 \to K^-\pi^+) = (3.80 \pm 0.09) \times 10^{-2}$. 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_{25}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.225±0.015 OUR AVERAGE				
$0.247 \pm 0.019 \pm 0.01$		[48] GIBBONS 97B	CLE2	$e^+e^- \to \Upsilon(4S)$
$0.205 \pm 0.019 \pm 0.007$		[49] ALBRECHT 96D	ARG	$e^+e^- \to \Upsilon(4S)$
$0.230 \pm 0.028 \pm 0.009$		[50] BORTOLETTO 92	CLEO	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.283 \pm 0.053 \pm 0.002$		[51] ALBRECHT 91H	ARG	Sup. by ALBRECHT 96D
$0.22 \pm 0.04 {}^{+0.07}_{-0.04}$	5200	[52] BORTOLETTO 87	CLEO	$e^+e^- \to \Upsilon(4S)$
$0.27 \pm 0.06 {}^{+0.08}_{-0.06}$	510	[53] CSORNA 85	CLEO	Repl. by BORTOLETTO 87

[48] GIBBONS 97B reports B($B \rightarrow D^*(2010)^+$ 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.

[49] ALBRECHT 96D reports B($B \rightarrow D^*(2010)^+$ anything) 0.196 ± 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 ± 0.0014, B($D^0 \rightarrow K^-\pi^+\pi^+\pi^-$) = 0.081 ± 0.005., We rescale to our PDG 96 values of D and D^* branching ratios. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

[51] ALBRECHT 91H reports $0.348 \pm 0.060 \pm 0.035$ for B($D^*(2010)^+ \rightarrow D^0\pi^+$) = 0.55 ± 0.04. We rescale to our best value B($D^*(2010)^+ \rightarrow D^0\pi^+$) = $(67.7 \pm 0.5) \times 10^{-2}$. 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 ± 0.0025.

[52] 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.

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

$\Gamma(D^*(2007)^0 \text{anything})/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.260±0.023±0.015	[54] GIBBONS	97B	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

[54] GIBBONS 97B reports B($B \rightarrow D^*(2007)^0$ 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_{27}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.105±0.026 OUR AVERAGE					
$0.109 \pm 0.006^{+0.026}_{-0.027}$		[55] AUBERT	02G	BABR	$e^+e^- \rightarrow \Upsilon(4S)$
$0.117 \pm 0.009^{+0.028}_{-0.029}$		[56] GIBAUT	96	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
$0.081 \pm 0.014^{+0.019}_{-0.020}$		[57] ALBRECHT	92G	ARG	$e^+e^- \rightarrow \Upsilon(4S)$
$0.085 \pm 0.013^{+0.020}_{-0.021}$	257	[58] BORTOLETTO	90	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
$0.105 \pm 0.028^{+0.025}_{-0.026}$		[59] HAAS	86	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.116 \pm 0.030 \pm 0.028$		[60] ALBRECHT	87H	ARG	$e^+e^- \rightarrow \Upsilon(4S)$

[55] AUBERT 02G reports [B($B \to D_s^{\pm}$ anything) $\times$ B($D_s^+ \to \phi\pi^+$)] $= 0.00393 \pm 0.00007 \pm 0.00021$. We divide by our best value B($D_s^+ \to \phi\pi^+$) $= (3.6 \pm 0.9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

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

[58] BORTOLETTO 90 reports [B($B \to D_s^{\pm}$ anything) $\times$ B($D_s^+ \to \phi\pi^+$)] $= 0.00306 \pm 0.00047$. We divide by our best value B($D_s^+ \to \phi\pi^+$) $= (3.6 \pm 0.9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

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

$\Gamma(D_s^{*\pm}$ anything$)/\Gamma_{total}$ — Γ_{28}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$0.079 \pm 0.011 \pm 0.019$	[61] AUBERT	02G	BABR	$e^+e^- \to \Upsilon(4S)$

[61] AUBERT 02G reports [B($B \to D_s^{*\pm}$ anything) $\times$ B($D_s^+ \to \phi\pi^+$)] $= 0.00284 \pm 0.00029 \pm 0.00025$. We divide by our best value B($D_s^+ \to \phi\pi^+$) $= (3.6 \pm 0.9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^{*\pm}\overline{D}^{(*)})/\Gamma(D_s^{*\pm}$ anything$)$ — Γ_{29}/Γ_{28}

Sum over modes

VALUE	DOCUMENT ID		TECN	COMMENT
$0.533 \pm 0.037 \pm 0.037$	AUBERT	02G	BABR	$e^+e^- \to \Upsilon(4S)$

$\left[\Gamma(D^{(*)}\overline{D}^{(*)}K^0) + \Gamma(D^{(*)}\overline{D}^{(*)}K^{\pm})\right]/\Gamma_{total}$ — Γ_{30}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$0.071^{+0.025}_{-0.015}{}^{+0.010}_{-0.009}$	[62] BARATE	98Q	ALEP	$e^+e^- \to Z$

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

$\Gamma(c\overline{c}s)/\Gamma_{total}$ — Γ_{31}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.219 ± 0.037	[63] COAN	98	CLE2	$e^+e^- \to \Upsilon(4S)$

[63] COAN 98 uses D-ℓ correlation.

$\Gamma(D_s^{(*)}\overline{D}^{(*)})/\Gamma(D_s^{\pm}\text{ anything})$ — Γ_{32}/Γ_{27}

Sum over modes.

VALUE	DOCUMENT ID		TECN	COMMENT
0.469±0.017 OUR AVERAGE				
0.464±0.013±0.015	AUBERT	02G	BABR	$e^+e^- \to \Upsilon(4S)$
$0.56\ ^{+0.21}_{-0.15}\ ^{+0.09}_{-0.08}$	[64] BARATE	98Q	ALEP	$e^+e^- \to Z$
0.457±0.019±0.037	GIBAUT	96	CLE2	$e^+e^- \to \Upsilon(4S)$
0.58 ±0.07 ±0.09	ALBRECHT	92G	ARG	$e^+e^- \to \Upsilon(4S)$
0.56 ±0.10	BORTOLETTO	90	CLEO	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(D^* D^*(2010)^{\pm})/\Gamma_{\text{total}}$ — Γ_{33}/Γ

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

$[\Gamma(D D^*(2010)^{\pm}) + \Gamma(D^* D^{\pm})]/\Gamma_{\text{total}}$ — Γ_{34}/Γ

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

$\Gamma(D D^{\pm})/\Gamma_{\text{total}}$ — Γ_{35}/Γ

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

$\Gamma(D_s{}^{(*)\pm}\overline{D}^{(*)}X(n\pi^{\pm}))/\Gamma_{\text{total}}$ — Γ_{36}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$0.094^{+0.040}_{-0.031}{}^{+0.034}_{-0.024}$	[65] BARATE	98Q	ALEP	$e^+e^- \to Z$

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

$\Gamma(D^*(2010)\gamma)/\Gamma_{\text{total}}$ — Γ_{37}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.1 \times 10^{-3}$	90	[66] LESIAK	92	CBAL	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(D_s^+\pi^-, D_s^{*+}\pi^-, D_s^+\rho^-, D_s^{*+}\rho^-, D_s^+\pi^0, D_s^{*+}\pi^0, D_s^+\eta, D_s^{*+}\eta, D_s^+\rho^0, D_s^{*+}\rho^0, D_s^+\omega, D_s^{*+}\omega)/\Gamma_{\text{total}}$ — Γ_{38}/Γ

Sum over modes.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0005	90	[67] ALEXANDER	93B	CLE2	$e^+e^- \to \Upsilon(4S)$

[67] ALEXANDER 93B reports $< 4.8 \times 10^{-4}$ for $B(D_s^+ \to \phi\pi^+) = 0.037$. We rescale to our best value $B(D_s^+ \to \phi\pi^+) = 0.036$. This branching ratio limit provides a model-dependent upper limit $|V_{ub}|/|V_{cb}| < 0.16$ at CL=90%.

$\Gamma(D_{s1}(2536)^+ \text{anything})/\Gamma_{total}$ — Γ_{39}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0095	90	[68] BISHAI	98	CLE2	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(J/\psi(1S)\text{anything})/\Gamma_{total}$ — Γ_{40}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.090±0.035 OUR NEW AVERAGE Error includes scale factor of 1.1. [(1.15 ± 0.06) × 10^{-2} OUR 2002 AVERAGE]					
1.057±0.012±0.040		[69] AUBERT	03F	BABR	$e^+e^- \to \Upsilon(4S)$
1.13 ±0.06 ±0.02	1489	[70] BALEST	95B	CLE2	$e^+e^- \to \Upsilon(4S)$
1.30 ±0.45 ±0.02	27	[71] MASCHMANN	90	CBAL	$e^+e^- \to \Upsilon(4S)$
1.24 ±0.27 ±0.02	120	[72] ALBRECHT	87D	ARG	$e^+e^- \to \Upsilon(4S)$
1.37 ±0.25 ±0.02	52	[73] ALAM	86	CLEO	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.4 $^{+0.6}_{-0.5}$	7	[74] ALBRECHT	85H	ARG	$e^+e^- \to \Upsilon(4S)$
1.1 ±0.21 ±0.23	46	[75] HAAS	85	CLEO	Repl. by ALAM 86

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

[70] BALEST 95B reports $1.12 \pm 0.04 \pm 0.06$ for $B(J/\psi(1S) \to e^+e^-) = 0.0599 \pm 0.0025$. We rescale to our best value $B(J/\psi(1S) \to e^+e^-) = (5.93 \pm 0.10) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.. They measure $J/\psi(1S) \to e^+e^-$ and $\mu^+\mu^-$ and use PDG 1994 values for the branching fractions. The rescaling is the same for either mode so we use e^+e^-.

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

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

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

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

[75] Dimuon and dielectron events used.

$\Gamma(J/\psi(1S)(\text{direct})\text{ anything})/\Gamma_{\text{total}}$ — Γ_{41}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0076 ±0.0004 OUR NEW AVERAGE [0.0080 ± 0.0008 OUR 2002 AVERAGE]			
0.00740±0.00023±0.00043	[76] AUBERT 03F	BABR	$e^+e^- \to \Upsilon(4S)$
0.0080 ±0.0008	[77] BALEST 95B	CLE2	$e^+e^- \to \Upsilon(4S)$

[76] AUBERT 03F also reports the helicity of $J/\psi \to \ell^+\ell^-$ produced directly in B decay.

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

$\Gamma(\psi(2S)\text{anything})/\Gamma_{\text{total}}$ — Γ_{42}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.00310±0.00024 OUR NEW AVERAGE [0.0035 ± 0.0005 OUR 2002 AVERAGE]				
0.00297±0.00020±0.00020		AUBERT 03F	BABR	$e^+e^- \to \Upsilon(4S)$
0.0034 ±0.0004 ±0.0003	240	[78] BALEST 95B	CLE2	$e^+e^- \to \Upsilon(4S)$
0.0046 ±0.0017 ±0.0011	8	ALBRECHT 87D	ARG	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\chi_{c1}(1P)\text{anything})/\Gamma_{\text{total}}$ — Γ_{43}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.00362±0.00027 OUR NEW AVERAGE [0.0036 ± 0.0005 OUR 2002 AVERAGE]				
0.00367±0.00035±0.00044		AUBERT 03F	BABR	$e^+e^- \to \Upsilon(4S)$
0.00363±0.00022±0.00034		[79] ABE 02L	BELL	$e^+e^- \to \Upsilon(4S)$
0.0036 ±0.0004 ±0.0003		[80] CHEN 01	CLE2	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0040 ±0.0006 ±0.0004	112	[81] BALEST 95B	CLE2	Repl. by CHEN 01
0.0105 ±0.0035 ±0.0025		[82] ALBRECHT 92E	ARG	$e^+e^- \to \Upsilon(4S)$

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

[80] CHEN 01 reports 0.00414±0.00031±0.00040 for B($\chi_{c1}(1P) \to \gamma J/\psi(1S)$) = 0.273± 0.016. We rescale to our best value B($\chi_{c1}(1P) \to \gamma J/\psi(1S)$) = $(31.6 \pm 2.7) \times 10^{-2}$. 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 $\Upsilon(4S)$.

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

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

$\Gamma(\chi_{c1}(1P)(\text{direct})\text{ anything})/\Gamma_{\text{total}}$ — Γ_{44}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.00334±0.00027 OUR NEW AVERAGE [0.0033 ± 0.0005 OUR 2002 AVERAGE]			
0.00341±0.00035±0.00042	AUBERT 03F	BABR	$e^+e^- \to \Upsilon(4S)$
0.00332±0.00022±0.00034	[83] ABE 02L	BELL	$e^+e^- \to \Upsilon(4S)$
0.0033 ±0.0004 ±0.0003	[84] CHEN 01	CLE2	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.0037 ±0.0007	[85] BALEST 95B	CLE2	Repl. by CHEN 01

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

[84] CHEN 01 reports $0.00383 \pm 0.00031 \pm 0.00040$ for B($\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = 0.273 \pm 0.016$. We rescale to our best value B($\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (31.6 \pm 2.7) \times 10^{-2}$. 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 $\Upsilon(4S)$.

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

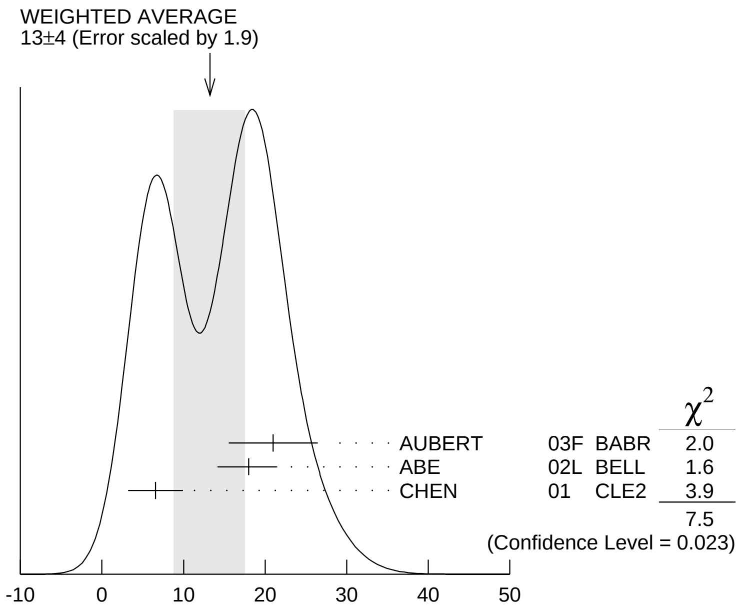
$\Gamma(\chi_{c2}(1P)\text{anything})/\Gamma_{total}$ Γ_{45}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
13 ±4 OUR NEW AVERAGE Error includes scale factor of 1.9. See the ideogram below. [$(7 \pm 4) \times 10^{-4}$ OUR 2002 AVERAGE]						
$21.0 \pm 4.5 \pm 3.1$			AUBERT	03F	BABR	$e^+ e^- \rightarrow \Upsilon(4S)$
$18.0^{+2.3}_{-2.8} \pm 2.6$			[86] ABE	02L	BELL	$e^+ e^- \rightarrow \Upsilon(4S)$
$6.5 \pm 3.3 \pm 0.6$			[87] CHEN	01	CLE2	$e^+ e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<38	90	35	[88] BALEST	95B	CLE2	Repl. by CHEN 01

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

[87] CHEN 01 reports $9.8 \pm 4.8 \pm 1.5$ for B($\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$. We rescale to our best value B($\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (20.2 \pm 1.8) \times 10^{-2}$. 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 $\Upsilon(4S)$.

[88] 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($B \rightarrow \chi_{c2}(1P)X) = (0.25 \pm 0.10 \pm 0.03) \times 10^{-2}$.



$\Gamma\big(\chi_{c2}(1P)\,\text{anything}\big)/\Gamma_{\text{total}}$ Γ_{45}/Γ

$\Gamma\big(\chi_{c2}(1P)\,(\text{direct})\,\text{anything}\big)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE		DOCUMENT ID		TECN	COMMENT
0.00165±0.00031 OUR AVERAGE					
0.00190±0.00045±0.00029		AUBERT	03F	BABR	$e^+e^- \to \Upsilon(4S)$
$0.00153^{+0.00023}_{-0.00028}\pm0.00027$	[89]	ABE	02L	BELL	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma\big(\eta_c(1S)\,\text{anything}\big)/\Gamma_{\text{total}}$ Γ_{47}/Γ

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

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

$\Gamma\big(K^\pm\,\text{anything}\big)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE		DOCUMENT ID		TECN	COMMENT
0.789±0.025 OUR AVERAGE					
0.82 ±0.01 ±0.05		ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
0.775±0.015±0.025	[91]	ALBRECHT	93I	ARG	$e^+e^- \to \Upsilon(4S)$
0.85 ±0.07 ±0.09		ALAM	87B	CLEO	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	[92]	BRODY	82	CLEO	$e^+e^- \to \Upsilon(4S)$
seen	[93]	GIANNINI	82	CUSB	$e^+e^- \to \Upsilon(4S)$

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

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

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

$\Gamma(K^+ \text{anything})/\Gamma_{total}$ — Γ_{49}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.66 ±0.05	[94] ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.620±0.013±0.038	[95] ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
0.66 ±0.05 ±0.07	[95] ALAM	87B	CLEO	$e^+e^- \to \Upsilon(4S)$

[94] 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 $(18.1 \pm 4.3)\%$.

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

$\Gamma(K^- \text{anything})/\Gamma_{total}$ — Γ_{50}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.13 ±0.04	[96] ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.165±0.011±0.036	[97] ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
0.19 ±0.05 ±0.02	[97] ALAM	87B	CLEO	$e^+e^- \to \Upsilon(4S)$

[96] 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 $(18.1 \pm 4.3)\%$.

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

$\Gamma(K^0/\overline{K}^0 \text{anything})/\Gamma_{total}$ — Γ_{51}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.64 ±0.04 OUR AVERAGE				
0.642±0.010±0.042	[98] ALBRECHT	94C	ARG	$e^+e^- \to \Upsilon(4S)$
0.63 ±0.06 ±0.06	ALAM	87B	CLEO	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(K^*(892)^\pm \text{anything})/\Gamma_{total}$ — Γ_{52}/Γ

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

$\Gamma(K^*(892)^0/\overline{K}^*(892)^0 \text{anything})/\Gamma_{total}$ — Γ_{53}/Γ

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

$\Gamma(K^*(892)\gamma)/\Gamma_{total}$ Γ_{54}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
4.24±0.54±0.32		[99] COAN	00	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<150	90	[100] LESIAK	92	CBAL	$e^+e^- \rightarrow \Upsilon(4S)$
< 24	90	ALBRECHT	88H	ARG	$e^+e^- \rightarrow \Upsilon(4S)$

[99] 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.
[100] LESIAK 92 set a limit on the inclusive process B($b \rightarrow s\gamma$) < 2.8×10^{-3} at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about s-quark hadronization.

$\Gamma(K_1(1400)\gamma)/\Gamma_{total}$ Γ_{55}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<12.7 × 10^−5	90	[101] COAN	00	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 1.6 \times 10^{-3}$	90	[102] LESIAK	92	CBAL	$e^+e^- \rightarrow \Upsilon(4S)$
$< 4.1 \times 10^{-4}$	90	ALBRECHT	88H	ARG	$e^+e^- \rightarrow \Upsilon(4S)$

[101] Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.
[102] LESIAK 92 set a limit on the inclusive process B($b \rightarrow s\gamma$) < 2.8×10^{-3} at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about s-quark hadronization.

$\Gamma(K_2^*(1430)\gamma)/\Gamma_{total}$ Γ_{56}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
$1.66^{+0.59}_{-0.53}\pm0.13$		[103] COAN	00	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<83	90	ALBRECHT	88H	ARG	$e^+e^- \rightarrow \Upsilon(4S)$

[103] 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.

$\Gamma(K_2(1770)\gamma)/\Gamma_{total}$ Γ_{57}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.2 × 10^−3	90	[104] LESIAK	92	CBAL	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(K_3^*(1780)\gamma)/\Gamma_{total}$ Γ_{58}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.0 × 10^−3	90	ALBRECHT	88H	ARG	$e^+e^- \rightarrow \Upsilon(4S)$

$\Gamma(K_4^*(2045)\gamma)/\Gamma_{total}$ Γ_{59}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.0 × 10^−3	90	[105] LESIAK	92	CBAL	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(\eta'(958)K)/\Gamma_{total}$ — Γ_{60}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$(8.3^{+0.9}_{-0.8}\pm0.7)\times10^{-5}$	[106] RICHICHI	00	CLE2	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\eta'(958)K^*(892))/\Gamma_{total}$ — Γ_{61}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.2\times10^{-5}$	90	[107] RICHICHI	00	CLE2	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\eta K)/\Gamma_{total}$ — Γ_{62}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<5.2\times10^{-6}$	90	[108] RICHICHI	00	CLE2	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\eta K^*(892))/\Gamma_{total}$ — Γ_{63}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$(1.80^{+0.49}_{-0.43}\pm0.18)\times10^{-5}$	[109] RICHICHI	00	CLE2	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\overline{b}\to\overline{s}\gamma)/\Gamma_{total}$ — Γ_{64}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
3.3 ±0.4 OUR NEW AVERAGE [$(3.3\pm0.4)\times10^{-4}$ OUR 2002 AVERAGE]				
$3.36\pm0.53^{+0.65}_{-0.68}$	[110] ABE	01F	BELL	$e^+e^- \to \Upsilon(4S)$
$3.21\pm0.43^{+0.32}_{-0.29}$	[111] CHEN	01C	CLE2	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.32\pm0.57\pm0.35$	ALAM	95	CLE2	Repl. by CHEN 01C

[110] ABE 01F reports their systematic errors $\pm0.42^{+0.50}_{-0.54}$, where the second error is due to the theoretical uncertainty. We combine them in quadrature.

[111] We have combined the experimental systematic theoretical uncertainties in quadrature. Also determined the first and second moments of the photon energy spectrum above 2.0 GeV: $\langle E_\gamma\rangle = 2.346\pm0.032\pm0.011$ GeV and $\langle E_\gamma^2\rangle-\langle E_\gamma\rangle^2 = 0.0226\pm0.0066\pm0.0020$ GeV^2.

$\Gamma(\overline{b}\to\overline{s}\,\text{gluon})/\Gamma_{total}$ — Γ_{65}/Γ

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<0.068	90		[112] COAN	98	CLE2	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.08		2	[113] ALBRECHT	95D	ARG	$e^+e^- \to \Upsilon(4S)$

[112] COAN 98 uses D-ℓ correlation.

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

$\Gamma(\eta \text{anything})/\Gamma_{\text{total}}$ — Γ_{66}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<4.4 \times 10^{-4}$	90	[114] BROWDER	98	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

[114] 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_{67}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$(6.2 \pm 1.6^{+1.3}_{-2.0}) \times 10^{-4}$	[115] BROWDER	98	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

[115] BROWDER 98 observed a signal of 39.0 $\pm$ 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_{68}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.4 \times 10^{-5}$	90	[116] COAN	00	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

[116] 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($B \rightarrow K^*(892)\gamma$)=$(4.24 \pm 0.54 \pm 0.32) \times 10^{-5}$.

$\Gamma(\pi^{\pm} \text{ anything})/\Gamma_{\text{total}}$ — Γ_{69}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
3.585±0.025±0.070	[117] ALBRECHT	93I	ARG	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(\pi^0 \text{ anything})/\Gamma_{\text{total}}$ — Γ_{70}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
2.35±0.02±0.11	[118] ABE	01J	BELL	$e^+e \rightarrow \Upsilon(4S)$

[118] From fully inclusive π^0 yield with no corrections from decays of K^0_S or other particles.

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

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

$\Gamma(\rho^0 \text{ anything})/\Gamma_{\text{total}}$ — Γ_{72}/Γ

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

$\Gamma(\omega \text{ anything})/\Gamma_{\text{total}}$ — Γ_{73}/Γ

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

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ — Γ_{74}/Γ

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

$\Gamma(\phi K^*(892))/\Gamma_{total}$ — Γ_{75}/Γ

VALUE	CL%	DOCUMENT ID		TECN
<2.2 × 10⁻⁵	90	[119] BERGFELD	98	CLE2

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

$\Gamma(\Lambda_c^{\pm}$ anything$)/\Gamma_{total}$ — Γ_{76}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
0.064±0.008±0.008		[120] CRAWFORD	92	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.14 ±0.09		[121] ALBRECHT	88E	ARG	$e^+e^- \rightarrow \Upsilon(4S)$
<0.112	90	[122] ALAM	87	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$

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

[121] ALBRECHT 88E measured B($B \rightarrow \Lambda_c^+ X$)·B($\Lambda_c^+ \rightarrow pK^-\pi^+$) = (0.30 ± 0.12 ± 0.06)% and used B($\Lambda_c^+ \rightarrow pK^-\pi^+$) = (2.2 ± 1.0)% from ABRAMS 80 to obtain above number.

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

$\Gamma(\Lambda_c^+$ anything$)/\Gamma(\overline{\Lambda}_c^-$ anything$)$ — Γ_{77}/Γ_{78}

VALUE	DOCUMENT ID		TECN	COMMENT
0.19±0.13±0.04	[123] AMMAR	97	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(\overline{\Lambda}_c^- e^+$ anything$)/\Gamma(\Lambda_c^{\pm}$ anything$)$ — Γ_{79}/Γ_{76}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.05	90	[124] BONVICINI	98	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(\overline{\Lambda}_c^- p$ anything$)/\Gamma(\Lambda_c^{\pm}$ anything$)$ — Γ_{80}/Γ_{76}

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

$\Gamma(\overline{\Lambda}_c^- p e^+ \nu_e)/\Gamma(\overline{\Lambda}_c^- p$ anything$)$ — Γ_{81}/Γ_{80}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.04	90	[125] BONVICINI	98	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(\overline{\Sigma}_c^{--}$ anything$)/\Gamma_{total}$ — Γ_{82}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0042±0.0021±0.0011	77	[126] PROCARIO	94	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(\overline{\Sigma}_c^- \text{ anything})/\Gamma_{total}$ — Γ_{83}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.010	90	[127] PROCARIO	94	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(\overline{\Sigma}_c^0 \text{anything})/\Gamma_{total}$ — Γ_{84}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0046±0.0021±0.0012	76	[128] PROCARIO	94	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

[128] PROCARIO 94 reports $[B(B \rightarrow \overline{\Sigma}_c^0 \text{anything}) \times B(\Lambda_c^+ \rightarrow pK^-\pi^+)] = 0.00023 \pm 0.00008 \pm 0.00007$. 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.

$\Gamma(\overline{\Sigma}_c^0 N (N = p \text{ or } n))/\Gamma_{total}$ — Γ_{85}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0015	90	[129] PROCARIO	94	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(\Xi_c^0 \text{anything} \times B(\Xi_c^0 \rightarrow \Xi^-\pi^+))/\Gamma_{total}$ — Γ_{86}/Γ

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
0.144±0.048±0.021	[130] BARISH	97	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

[130] BARISH 97 find 79 ± 27 Ξ_c^0 events.

$\Gamma(\Xi_c^+ \text{anything} \times B(\Xi_c^+ \rightarrow \Xi^-\pi^+\pi^+))/\Gamma_{total}$ — Γ_{87}/Γ

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.453 \pm 0.096^{+0.085}_{-0.065}}$	[131] BARISH	97	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

[131] BARISH 97 find 125 ± 28 Ξ_c^+ events.

$\Gamma(p/\overline{p} \text{anything})/\Gamma_{total}$ — Γ_{88}/Γ

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.080±0.004 OUR AVERAGE					
0.080±0.005±0.005		ALBRECHT	93I	ARG	$e^+e^- \rightarrow \Upsilon(4S)$
0.080±0.005±0.003		CRAWFORD	92	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
$0.082 \pm 0.005^{+0.013}_{-0.010}$	2163	[132] ALBRECHT	89K	ARG	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>0.021		[133] ALAM	83B	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$

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

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

$\Gamma(p/\overline{p}(\text{direct})\,\text{anything})/\Gamma_{\text{total}}$ — Γ_{89}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.055±0.005 OUR AVERAGE					
0.055±0.005±0.0035		ALBRECHT	93I	ARG	$e^+e^- \to \Upsilon(4S)$
0.056±0.006±0.005		CRAWFORD	92	CLEO	$e^+e^- \to \Upsilon(4S)$
0.055±0.016	1220	[134] ALBRECHT	89K	ARG	$e^+e^- \to \Upsilon(4S)$

[134] ALBRECHT 89K subtract contribution of Λ decay from the inclusive proton yield.

$\Gamma(\Lambda/\overline{\Lambda}\,\text{anything})/\Gamma_{\text{total}}$ — Γ_{90}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.040±0.005 OUR AVERAGE					
0.038±0.004±0.006	2998	CRAWFORD	92	CLEO	$e^+e^- \to \Upsilon(4S)$
0.042±0.005±0.006	943	ALBRECHT	89K	ARG	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.022±0.003±0.0022		[135] ACKERSTAFF	97N	OPAL	$e^+e^- \to Z$
>0.011		[136] ALAM	83B	CLEO	$e^+e^- \to \Upsilon(4S)$

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

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

$\Gamma(\Lambda\,\text{anything})/\Gamma(\overline{\Lambda}\,\text{anything})$ — Γ_{91}/Γ_{92}

VALUE	DOCUMENT ID		TECN	COMMENT
0.43±0.09±0.07	[137] AMMAR	97	CLE2	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\Xi^-/\overline{\Xi}^+\,\text{anything})/\Gamma_{\text{total}}$ — Γ_{93}/Γ

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

$\Gamma(\text{baryons anything})/\Gamma_{\text{total}}$ — Γ_{94}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.068±0.005±0.003	[138] ALBRECHT	92O	ARG	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.076±0.014	[139] ALBRECHT	89K	ARG	$e^+e^- \to \Upsilon(4S)$

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

[139] ALBRECHT 89K obtain this result by adding their their measurements (5.5 ± 1.6)% for direct protons and (4.2 ± 0.5 ± 0.6)% for inclusive 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)%.

$\Gamma(p\overline{p}\text{anything})/\Gamma_{total}$ — Γ_{95}/Γ

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

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

$\Gamma(p\overline{p}\text{anything})/\Gamma(p/\overline{p}\text{anything})$ — Γ_{95}/Γ_{88}

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

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.30±0.02±0.05	[140] CRAWFORD	92	CLEO	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\Lambda\overline{p}/\overline{\Lambda}p\text{anything})/\Gamma_{total}$ — Γ_{96}/Γ

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

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

$\Gamma(\Lambda\overline{p}/\overline{\Lambda}p\text{anything})/\Gamma(\Lambda/\overline{\Lambda}\text{anything})$ — Γ_{96}/Γ_{90}

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

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.76±0.11±0.08	[141] CRAWFORD	92	CLEO	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(\Lambda\overline{\Lambda}\text{anything})/\Gamma_{total}$ — Γ_{97}/Γ

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

$\Gamma(\Lambda\overline{\Lambda}\text{anything})/\Gamma(\Lambda/\overline{\Lambda}\text{anything})$ — Γ_{97}/Γ_{90}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.13	90	[142] CRAWFORD	92	CLEO	$e^+e^- \to \Upsilon(4S)$

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

$\Gamma(s e^+ e^-)/\Gamma_{total}$ — Γ_{98}/Γ

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

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
$5.0\pm2.3^{+1.3}_{-1.1}$		[143] KANEKO	03	BELL	$e^+e^- \to \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 57	90	GLENN	98	CLEO	$e^+e^- \to \Upsilon(4S)$
<50000	90	BEBEK	81	CLEO	$e^+e^- \to \Upsilon(4S)$

[143] KANEKO 03 requires $M(e^+e^-) > 0.2$ GeV/c^2.

$\Gamma(s\mu^+\mu^-)/\Gamma_{total}$ — Γ_{99}/Γ

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

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{7.9 \pm 2.1^{+2.1}_{-1.5}}$		KANEKO	03	BELL	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<$ 58	90	GLENN	98	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
$<$17000	90	CHADWICK	81	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$

$[\Gamma(se^+e^-) + \Gamma(s\mu^+\mu^-)]/\Gamma_{total}$ — $(\Gamma_{98}+\Gamma_{99})/\Gamma$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<4.2 \times 10^{-5}}$	90	GLENN	98	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<$0.0024	90	[144] BEAN	87	CLEO	Repl. by GLENN 98
$<$0.0062	90	[145] AVERY	84	CLEO	Repl. by BEAN 87

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

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

$\Gamma(s\ell^+\ell^-)/\Gamma_{total}$ — Γ_{100}/Γ

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

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{(6.1 \pm 1.4^{+1.4}_{-1.1}) \times 10^{-6}}$	[146] KANEKO	03	BELL	$e^+e^- \rightarrow \Upsilon(4S)$

[146] KANEKO 03 requires $M(e^+e^-) > 0.2$ GeV/c^2.

$\Gamma(Ke^+e^-)/\Gamma_{total}$ — Γ_{101}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<1.3 \times 10^{-6}}$	90	ABE	02	BELL	$e^+e^- \rightarrow \Upsilon(4S)$

$\Gamma(K^*(892)e^+e^-)/\Gamma_{total}$ — Γ_{102}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<5.6 \times 10^{-6}}$	90	ABE	02	BELL	$e^+e^- \rightarrow \Upsilon(4S)$

$\Gamma(K\mu^+\mu^-)/\Gamma_{total}$ — Γ_{103}/Γ

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

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{(0.99^{+0.40}_{-0.32}{}^{+0.13}_{-0.14}) \times 10^{-6}}$	ABE	02	BELL	$e^+e^- \rightarrow \Upsilon(4S)$

$\Gamma(K^*(892)\mu^+\mu^-)/\Gamma_{total}$ — Γ_{104}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<3.1 \times 10^{-6}}$	90	ABE	02	BELL	$e^+e^- \rightarrow \Upsilon(4S)$

$\Gamma(K\ell^+\ell^-)/\Gamma_{total}$ — Γ_{105}/Γ

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

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
$0.75^{+0.25}_{-0.21}\pm0.06$		[147] ABE	02	BELL	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.51	90	[148] AUBERT	02L	BABR	$e^+e^- \rightarrow \Upsilon(4S)$
<1.7	90	[149] ANDERSON	01B	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

[147] Assumes lepton universality.
[148] Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.
[149] The result is for di-lepton masses above 0.5 GeV.

$\Gamma(K^*(892)\ell^+\ell^-)/\Gamma_{total}$ — Γ_{106}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.1 \times 10^{-6}$ (CL = 90%) [$<3.3 \times 10^{-6}$ (CL = 90%) OUR 2002 BEST LIMIT]					
$<3.1 \times 10^{-6}$	90	[150,151] AUBERT	02L	BABR	$e^+e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<3.3 \times 10^{-6}$	90	[152] ANDERSON	01B	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

[150] Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.
[151] For averaging $K^*(892)\mu^+\mu^-$ and $K^*(892)e^+e^-$ modes, AUBERT 02L assumed $B(B \rightarrow K^*(892)e^+e^-)/B(B \rightarrow K^*(892)\mu^+\mu^-) = 1.2$.
[152] The result is for di-lepton masses above 0.5 GeV.

$\Gamma(e^\pm\mu^\mp s)/\Gamma_{total}$ — Γ_{107}/Γ

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

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

$\Gamma(\pi e^\pm\mu^\mp)/\Gamma_{total}$ — Γ_{108}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.6 \times 10^{-6}$	90	[153] EDWARDS	02B	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(\rho e^\pm\mu^\mp)/\Gamma_{total}$ — Γ_{109}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.2 \times 10^{-6}$	90	[154] EDWARDS	02B	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(K e^\pm\mu^\mp)/\Gamma_{total}$ — Γ_{110}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.6 \times 10^{-6}$	90	[155] EDWARDS	02B	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$

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

$\Gamma(K^*(892)e^\pm\mu^\mp)/\Gamma_{total}$ — Γ_{111}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.2\times10^{-6}$	90	[156] EDWARDS	02B	CLE2	$e^+e^-\to\Upsilon(4S)$

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

CP VIOLATION

A_{CP} is defined as

$$\frac{B(B\to\overline{f})-B(\overline{B}\to f)}{B(B\to\overline{f})+B(\overline{B}\to f)},$$

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
-0.01 ± 0.07 OUR AVERAGE				
$-0.044\pm0.076\pm0.012$	[157] AUBERT	02C	BABR	$e^+e^-\to\Upsilon(4S)$
$+0.08\pm0.13\pm0.03$	[158] COAN	00	CLE2	$e^+e^-\to\Upsilon(4S)$

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

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
$-0.079\pm0.108\pm0.022$	[159] COAN	01	CLE2	$e^+e^-\to\Upsilon(4S)$

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

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

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

VALUE (GeV^2)	DOCUMENT ID		TECN	COMMENT
$0.251\pm0.023\pm0.062$	[160] CRONIN-HEN..	01B	CLE2	$e^+e^-\to\Upsilon(4S)$

[160] The leptons are required to have $P_1>1.5$ GeV/c.

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

VALUE (GeV^4)	DOCUMENT ID		TECN	COMMENT
$0.576\pm0.048\pm0.168$	[161] CRONIN-HEN..	01B	CLE2	$e^+e^-\to\Upsilon(4S)$

[161] The leptons are required to have $P_1>1.5$ GeV/c.

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

VALUE (GeV^4)	DOCUMENT ID		TECN	COMMENT
$0.639\pm0.056\pm0.178$	[162] CRONIN-HEN..	01B	CLE2	$e^+e^-\to\Upsilon(4S)$

[162] The leptons are required to have $P_1>1.5$ GeV/c.

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