$B^{\pm}/B^0/B^0_s/b$-baryon ADMIXTURE

NODE=S051

$B^{\pm}/B^0/B^0_s/b$-baryon ADMIXTURE MEAN LIFE

NODE=S051208

Each measurement of the B mean life is an average over an admixture of various bottom mesons and baryons which decay weakly. Different techniques emphasize different admixtures of produced particles, which could result in a different B mean life.

NODE=S051208

"OUR EVALUATION" is an average of the data listed below performed by the LEP B Lifetime Working Group as described in our review "Production and Decay of b-flavored Hadrons" in the $B^{\pm}$ Section of these Listings. The averaging procedure takes into account correlations between the measurements and asymmetric lifetime errors, but ignores the small differences due to different techniques.

NODE=S051T

NODE=S051T

→ NOT CHECKED ←

VALUE (10^{-12} s)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.564±0.014 OUR EVALUATION					
$1.533\pm0.015^{+0.035}_{-0.031}$		[1] ABE	98B	CDF	$p\overline{p}$ at 1.8 TeV
1.549±0.009±0.015		[2] ACCIARRI	98	L3	$e^+e^- \to Z$
1.611±0.010±0.027		[3] ACKERSTAFF	97F	OPAL	$e^+e^- \to Z$
1.582±0.011±0.027		[3] ABREU	96E	DLPH	$e^+e^- \to Z$
1.533±0.013±0.022	19.8k	[4] BUSKULIC	96F	ALEP	$e^+e^- \to Z$
1.564±0.030±0.036		[5] ABE,K	95B	SLD	$e^+e^- \to Z$
1.542±0.021±0.045		[6] ABREU	94L	DLPH	$e^+e^- \to Z$
1.523±0.034±0.038	5372	[7] ACTON	93L	OPAL	$e^+e^- \to Z$
1.535±0.035±0.028	7357	[7] ADRIANI	93K	L3	$e^+e^- \to Z$
1.511±0.022±0.078		[8] BUSKULIC	93O	ALEP	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.575±0.010±0.026		[9] ABREU	96E	DLPH	$e^+e^- \to Z$
$1.50\ ^{+0.24}_{-0.21}\ \pm0.03$		[10] ABREU	94P	DLPH	$e^+e^- \to Z$
1.46 ±0.06 ±0.06	5344	[11] ABE	93J	CDF	Repl. by ABE 98B
$1.23\ ^{+0.14}_{-0.13}\ \pm0.15$	188	[12] ABREU	93D	DLPH	Sup. by ABREU 94L
1.49 ±0.11 ±0.12	253	[13] ABREU	93G	DLPH	Sup. by ABREU 94L
$1.51\ ^{+0.16}_{-0.14}\ \pm0.11$	130	[14] ACTON	93C	OPAL	$e^+e^- \to Z$
1.28 ±0.10		[15] ABREU	92	DLPH	Sup. by ABREU 94L
1.37 ±0.07 ±0.06	1354	[16] ACTON	92	OPAL	Sup. by ACTON 93L
1.49 ±0.03 ±0.06		[17] BUSKULIC	92F	ALEP	Sup. by BUSKULIC 96F
$1.35\ ^{+0.19}_{-0.17}\ \pm0.05$		[18] BUSKULIC	92G	ALEP	$e^+e^- \to Z$
1.32 ±0.08 ±0.09	1386	[19] ADEVA	91H	L3	Sup. by ADRIANI 93K
$1.32\ ^{+0.31}_{-0.25}\ \pm0.15$	37	[20] ALEXANDER	91G	OPAL	$e^+e^- \to Z$
1.29 ±0.06 ±0.10	2973	[21] DECAMP	91C	ALEP	Sup. by BUSKULIC 92F
$1.36\ ^{+0.25}_{-0.23}$		[22] HAGEMANN	90	JADE	E^{ee}_{cm}= 35 GeV
1.13 ±0.15		[23] LYONS	90	RVUE	
1.35 ±0.10 ±0.24		BRAUNSCH...	89B	TASS	E^{ee}_{cm}= 35 GeV
0.98 ±0.12 ±0.13		ONG	89	MRK2	E^{ee}_{cm}= 29 GeV
$1.17\ ^{+0.27}_{-0.22}\ ^{+0.17}_{-0.16}$		KLEM	88	DLCO	E^{ee}_{cm}= 29 GeV
1.29 ±0.20 ±0.21		[24] ASH	87	MAC	E^{ee}_{cm}= 29 GeV
$1.02\ ^{+0.42}_{-0.39}$	301	[25] BROM	87	HRS	E^{ee}_{cm}= 29 GeV

OCCUR=2

[1] Measured using inclusive $J/\psi(1S) \to \mu^+\mu^-$ vertex. NODE=S051T;LINKAGE=CD

[2] ACCIARRI 98 uses inclusively reconstructed secondary vertex and lepton impact parameter. NODE=S051T;LINKAGE=S

[3] ACKERSTAFF 97F uses inclusively reconstructed secondary vertices. NODE=S051T;LINKAGE=R1

[4] BUSKULIC 96F analyzed using 3D impact parameter. NODE=S051T;LINKAGE=R

[5] ABE,K 95B uses an inclusive topological technique. NODE=S051T;LINKAGE=N

[6] ABREU 94L uses charged particle impact parameters. Their result from inclusively reconstructed secondary vertices is superseded by ABREU 96E. NODE=S051T;LINKAGE=FA

[7] ACTON 93L and ADRIANI 93K analyzed using lepton (e and μ) impact parameter at Z. NODE=S051T;LINKAGE=M

[8] BUSKULIC 93O analyzed using dipole method. NODE=S051T;LINKAGE=O

[9] Combines ABREU 96E secondary vertex result with ABREU 94L impact parameter result. NODE=S051T;LINKAGE=R2

[10] From proper time distribution of $b \to J/\psi(1S)$anything. NODE=S051T;LINKAGE=F

[11] ABE 93J analyzed using $J/\psi(1S) \rightarrow \mu\mu$ vertices. NODE=S051T;LINKAGE=P

[12] ABREU 93D data analyzed using $D/D^* \ell$anything event vertices. NODE=S051T;LINKAGE=CC

[13] ABREU 93G data analyzed using charged and neutral vertices. NODE=S051T;LINKAGE=BC

[14] ACTON 93C analysed using $D/D^* \ell$anything event vertices. NODE=S051T;LINKAGE=A

[15] ABREU 92 is combined result of muon and hadron impact parameter analyses. Hadron tracks gave $(12.7 \pm 0.4 \pm 1.2) \times 10^{-13}$ s for an admixture of B species weighted by production fraction and mean charge multiplicity, while muon tracks gave $(13.0 \pm 1.0 \pm 0.8) \times 10^{-13}$ s for an admixture weighted by production fraction and semileptonic branching fraction. NODE=S051T;LINKAGE=H

[16] ACTON 92 is combined result of muon and electron impact parameter analyses. NODE=S051T;LINKAGE=L

[17] BUSKULIC 92F uses the lepton impact parameter distribution for data from the 1991 run. NODE=S051T;LINKAGE=EE

[18] BUSKULIC 92G use $J/\psi(1S)$ tags to measure the average b lifetime. This is comparable to other methods only if the $J/\psi(1S)$ branching fractions of the different b-flavored hadrons are in the same ratio. NODE=S051T;LINKAGE=E

[19] Using $Z \rightarrow e^+ X$ or $\mu^+ X$, ADEVA 91H determined the average lifetime for an admixture of B hadrons from the impact parameter distribution of the lepton. NODE=S051T;LINKAGE=K

[20] Using $Z \rightarrow J/\psi(1S)X$, $J/\psi(1S) \rightarrow \ell^+\ell^-$, ALEXANDER 91G determined the average lifetime for an admixture of B hadrons from the decay point of the $J/\psi(1S)$. NODE=S051T;LINKAGE=J

[21] Using $Z \rightarrow eX$ or μX, DECAMP 91C determines the average lifetime for an admixture of B hadrons from the signed impact parameter distribution of the lepton. NODE=S051T;LINKAGE=D

[22] HAGEMANN 90 uses electrons and muons in an impact parameter analysis. NODE=S051T;LINKAGE=BQ

[23] LYONS 90 combine the results of the B lifetime measuresments of ONG 89, BRAUNSCHWEIG 89B, KLEM 88, and ASH 87, and JADE data by private communication. They use statistical techniques which include variation of the error with the mean life, and possible correlations between the systematic errors. This result is not independent of the measured results used in our average. NODE=S051T;LINKAGE=C

[24] We have combined an overall scale error of 15% in quadrature with the systematic error of ± 0.7 to obtain ± 2.1 systematic error. NODE=S051T;LINKAGE=G

[25] Statistical and systematic errors were combined by BROM 87. NODE=S051T;LINKAGE=I

CHARGED b-HADRON ADMIXTURE MEAN LIFE

NODE=S051218

NODE=S051T1

VALUE (10^{-12} s)	*DOCUMENT ID*		*TECN*	*COMMENT*
1.72±0.08±0.06	[26] ADAM	95	DLPH	$e^+e^- \rightarrow Z$

[26] ADAM 95 data analyzed using vertex-charge technique to tag b-hadron charge. NODE=S051T1;LINKAGE=F

NEUTRAL b-HADRON ADMIXTURE MEAN LIFE

NODE=S051228

NODE=S051T2

VALUE (10^{-12} s)	*DOCUMENT ID*		*TECN*	*COMMENT*
1.58±0.11±0.09	[27] ADAM	95	DLPH	$e^+e^- \rightarrow Z$

[27] ADAM 95 data analyzed using vertex-charge technique to tag b-hadron charge. NODE=S051T2;LINKAGE=F

MEAN LIFE RATIO $\tau_{\text{charged } b\text{−hadron}}/\tau_{\text{neutral } b\text{−hadron}}$

NODE=S051238

NODE=S051DT

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{1.09^{+0.11}_{-0.10}\pm 0.08}$	[28] ADAM	95	DLPH	$e^+e^- \rightarrow Z$

[28] ADAM 95 data analyzed using vertex-charge technique to tag b-hadron charge. NODE=S051DT;LINKAGE=F

$|\Delta\tau_b|/\tau_{b,\overline{b}}$

NODE=S051239

$\tau_{b,\overline{b}}$ and $|\Delta\tau_b|$ are the mean life average and difference between b and $\overline{b}$ hadrons. NODE=S051239

NODE=S051DTB

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
−0.001±0.012±0.008	[29] ABBIENDI	99J	OPAL	$e^+e^- \rightarrow Z$

[29] Data analyzed using both the jet charge and the charge of secondary vertex in the opposite hemisphere. NODE=S051DTB;LINKAGE=A

$\overline{b}$ PRODUCTION FRACTIONS AND DECAY MODES

NODE=S051210;NODE=S051

The branching fraction measurements are for an admixture of B mesons and baryons at energies above the $\Upsilon(4S)$. Only the highest energy results (LEP, Tevatron, $Sp\overline{p}S$) are used in the branching fraction averages. The production fractions give our best current estimate of the admixture at LEP.

NODE=S051

For inclusive branching fractions, *e.g.*, $B \to D^{\pm}$ 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.

The modes below are listed for a $\overline{b}$ initial state. b modes are their charge conjugates. Reactions indicate the weak decay vertex and do not include mixing.

	Mode		Fraction (Γ_i/Γ)	Confidence level	

PRODUCTION FRACTIONS

NODE=S051;CLUMP=P

The production fractions for weakly decaying b-hadrons at the Z have been calculated from the best values of mean lives, mixing parameters, and branching fractions in this edition by the LEP B Oscillation Working Group as described in the note "Production and Decay of b-Flavored Hadrons" in the $B^{\pm}$ Particle Listings. Values assume

NODE=S051

$$\mathrm{B}(\overline{b} \to B^+) = \mathrm{B}(\overline{b} \to B^0)$$
$$\mathrm{B}(\overline{b} \to B^+) + \mathrm{B}(\overline{b} \to B^0) + \mathrm{B}(\overline{b} \to B^0_s) + \mathrm{B}(b \to b\text{-baryon}) = 100\ \%.$$

The notation for production fractions varies in the literature (f_{B^0}, $f(b \to \overline{B}^0)$, $\mathrm{Br}(b \to \overline{B}^0)$). We use our own branching fraction notation here, $\mathrm{B}(\overline{b} \to B^0)$.

	Mode		Fraction (Γ_i/Γ)	
Γ_1	B^+		$(39.7 {}^{+1.8}_{-2.2})$ %	DESIG=1;OUR EVAL;→ NOT CHECKED ←
Γ_2	B^0		$(39.7 {}^{+1.8}_{-2.2})$ %	DESIG=2;OUR EVAL;→ NOT CHECKED ←
Γ_3	B^0_s		$(10.5 {}^{+1.8}_{-1.7})$ %	DESIG=3;OUR EVAL;→ NOT CHECKED ←
Γ_4	b-baryon		$(10.1 {}^{+3.9}_{-3.1})$ %	DESIG=4;OUR EVAL;→ NOT CHECKED ←
Γ_5	B_c		—	DESIG=30;OUR EVAL; → NOT CHECKED ←

DECAY MODES

NODE=S051;CLUMP=L

Semileptonic and leptonic modes

	Mode		Fraction (Γ_i/Γ)	
Γ_6	ν anything		(23.1 ± 1.5) %	DESIG=23
Γ_7	$\ell^+ \nu_\ell$ anything	[a,b]	(10.99 ± 0.23) %	DESIG=131
Γ_8	$e^+ \nu_e$ anything	[a]	(10.9 ± 0.5) %	DESIG=100
Γ_9	$\mu^+ \nu_\mu$ anything	[a]	(10.8 ± 0.5) %	DESIG=102
Γ_{10}	$D^- \ell^+ \nu_\ell$ anything	[b]	(2.02 ± 0.29) %	DESIG=15
Γ_{11}	$\overline{D}^0 \ell^+ \nu_\ell$ anything	[b]	(6.6 ± 0.6) %	DESIG=16
Γ_{12}	$D^{*-} \ell^+ \nu_\ell$ anything	[b]	(2.76 ± 0.29) %	DESIG=17
Γ_{13}	$\overline{D}^0_j \ell^+ \nu_\ell$ anything	[b,c]	seen	DESIG=18
Γ_{14}	$D^-_j \ell^+ \nu_\ell$ anything	[b,c]	seen	DESIG=19
Γ_{15}	$\overline{D}^*_2(2460)^0 \ell^+ \nu_\ell$ anything		seen	DESIG=21
Γ_{16}	$D^*_2(2460)^- \ell^+ \nu_\ell$ anything		seen	DESIG=22
Γ_{17}	charmless $\ell \overline{\nu}_\ell$	[b]	(1.9 ± 0.7) $\times 10^{-3}$	DESIG=31
Γ_{18}	$\tau^+ \nu_\tau$ anything		(2.6 ± 0.4) %	DESIG=172
Γ_{19}	$\overline{c} \to \ell^- \overline{\nu}_\ell$ anything	[b]	(7.8 ± 0.6) %	DESIG=219

	Charmed meson and baryon modes				NODE=S051;CLUMP=M
Γ_{20}	$\overline{D}^0$ anything		(60.5 ± 3.2) %		DESIG=24
Γ_{21}	$D^0 D_s^\pm$ anything	[d]	($9.1^{+3.9}_{-2.8}$) %		DESIG=50
Γ_{22}	$D^\mp D_s^\pm$ anything	[d]	($4.0^{+2.3}_{-1.8}$) %		DESIG=51
Γ_{23}	$\overline{D}^0 D^0$ anything	[d]	($5.1^{+2.0}_{-1.8}$) %		DESIG=47
Γ_{24}	$D^0 D^\pm$ anything	[d]	($2.7^{+1.8}_{-1.6}$) %		DESIG=48
Γ_{25}	$D^\pm D^\mp$ anything	[d]	< 9 $\times 10^{-3}$	90%	DESIG=49
Γ_{26}	D^- anything		(23.7 ± 2.3) %		DESIG=25
Γ_{27}	$D^*(2010)^+$ anything		(17.3 ± 2.0) %		DESIG=46
Γ_{28}	$D_1(2420)^0$ anything		(5.0 ± 1.5) %		DESIG=42
Γ_{29}	$D^*(2010)^\mp D_s^\pm$ anything	[d]	($3.3^{+1.6}_{-1.3}$) %		DESIG=52
Γ_{30}	$D^0 D^*(2010)^\pm$ anything	[d]	($3.0^{+1.1}_{-0.9}$) %		DESIG=53
Γ_{31}	$D^*(2010)^\pm D^\mp$ anything	[d]	($2.5^{+1.2}_{-1.0}$) %		DESIG=54
Γ_{32}	$D^*(2010)^\pm D^*(2010)^\mp$ anything	[d]	(1.2 ± 0.4) %		DESIG=55
Γ_{33}	$\overline{D}_2^*(2460)^0$ anything		(4.7 ± 2.7) %		DESIG=43
Γ_{34}	$\overline{D}_s$ anything		(18 ± 5) %		DESIG=26
Γ_{35}	Λ_c anything		(9.7 ± 2.9) %		DESIG=27
Γ_{36}	$\overline{c}\,/\,c$ anything	[e]	(117 ± 4) %		DESIG=28
	Charmonium modes				NODE=S051;CLUMP=N
Γ_{37}	$J/\psi(1S)$ anything		(1.16 ± 0.10) %		DESIG=106
Γ_{38}	$\psi(2S)$ anything		(4.8 ± 2.4) $\times 10^{-3}$		DESIG=124
Γ_{39}	$\chi_{c1}(1P)$ anything		(1.8 ± 0.5) %		DESIG=170
	***K* or *K** modes**				NODE=S051;CLUMP=O
Γ_{40}	$\overline{s}\gamma$		(3.1 ± 1.1) $\times 10^{-4}$		DESIG=185
Γ_{41}	$K^\pm$ anything		(74 ± 6) %		DESIG=10
Γ_{42}	K^0_S anything		(29.0 ± 2.9) %		DESIG=11
	Pion modes				NODE=S051;CLUMP=C
Γ_{43}	$\pi^\pm$ anything		(397 ±21) %		DESIG=44
Γ_{44}	π^0 anything	[e]	(278 ±60) %		DESIG=5
	Baryon modes				NODE=S051;CLUMP=A
Γ_{45}	$p\,/\,\overline{p}$ anything		(13.1 ± 1.1) %		DESIG=12
	Other modes				NODE=S051;CLUMP=B
Γ_{46}	charged anything	[e]	(497 ± 7) %		DESIG=14
Γ_{47}	hadron$^+$ hadron$^-$		($1.7^{+1.0}_{-0.7}$) $\times 10^{-5}$		DESIG=29
Γ_{48}	charmless		(7 ±21) $\times 10^{-3}$		DESIG=7
	Baryon modes				NODE=S051;CLUMP=A
Γ_{49}	$\Lambda\,/\,\overline{\Lambda}$ anything		(5.9 ± 0.6) %		DESIG=13
Γ_{50}	b-baryon anything		(10.2 ± 2.8) %		DESIG=45
	$\Delta B = 1$ weak neutral current (*B1*) modes				NODE=S051;CLUMP=R
Γ_{51}	$e^+ e^-$ anything				DESIG=103
Γ_{52}	$\mu^+ \mu^-$ anything	*B1*	< 3.2 $\times 10^{-4}$	90%	DESIG=104
Γ_{53}	$\nu\overline{\nu}$ anything				DESIG=20

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

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

[c] D_j represents an unresolved mixture of pseudoscalar and tensor D^{**} (P-wave) states. LINKAGE=DJ

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

[e] Inclusive branching fractions have a multiplicity definition and can be greater than 100%. LINKAGE=M

$B^{\pm}/B^0/B^0_s/b$-baryon ADMIXTURE BRANCHING RATIOS

NODE=S051215

$\Gamma(\nu\,\text{anything})/\Gamma_{\text{total}}$ Γ_6/Γ

NODE=S051R6
NODE=S051R6

VALUE	DOCUMENT ID	TECN	COMMENT
0.2308±0.0077±0.0124	[30,31] ACCIARRI 96C	L3	$e^+e^- \to Z$

[30] ACCIARRI 96C assumes relative b semileptonic decay rates e:μ:τ of 1:1:0.25. Based on missing-energy spectrum. NODE=S051R6;LINKAGE=MS

[31] Assumes Standard Model value for R_B. NODE=S051R6;LINKAGE=SM

$\Gamma(\ell^+\nu_\ell\,\text{anything})/\Gamma_{\text{total}}$ Γ_7/Γ

NODE=S051S45

These branching fraction values are model dependent. See the note on "Semileptonic Decays of D and B Mesons, Part II" at the beginning of the B^+ Particle Listings. NODE=S051S45

NODE=S051S45

VALUE	DOCUMENT ID	TECN	COMMENT
0.1099±0.0023 OUR AVERAGE	Includes data from the 2 datablocks that follow this one.		
0.1106±0.0039±0.0022	[32] ABREU 95D	DLPH	$e^+e^- \to Z$
0.114 ±0.003 ±0.004	[33] BUSKULIC 94G	ALEP	$e^+e^- \to Z$
0.105 ±0.006 ±0.005	[34] AKERS 93B	OPAL	$e^+e^- \to Z$

[32] ABREU 95D give systematic errors ±0.0019 (model) and 0.0012 (R_c). We combine these in quadrature. NODE=S051S45;LINKAGE=B

[33] BUSKULIC 94G uses e and μ events. This value is from a global fit to the lepton p and p_T (relative to jet) spectra which also determines the b and c production fractions, the fragmentation functions, and the forward-backward asymmetries. This branching ratio depends primarily on the ratio of dileptons to single leptons at high p_T, but the lower p_T portion of the lepton spectrum is included in the global fit to reduce the model dependence. The model dependence is ±0.0026 and is included in the systematic error. NODE=S051S45;LINKAGE=A

[34] AKERS 93B analysis performed using single and dilepton events. NODE=S051S45;LINKAGE=SB

$\Gamma(e^+\nu_e\,\text{anything})/\Gamma_{\text{total}}$ Γ_8/Γ

NODE=S051S1

These branching fraction values are model dependent. See the note on "Semileptonic Decays of D and B Mesons, Part II" at the beginning of the B^+ Particle Listings. NODE=S051S1

NODE=S051S1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.				
0.109 ±0.005 OUR AVERAGE				
0.1089±0.0020±0.0051		[35,36] ACCIARRI 96C	L3	$e^+e^- \to Z$
0.107 ±0.015 ±0.007	260	[37] ABREU 93C	DLPH	$e^+e^- \to Z$
0.109 $^{+0.014}_{-0.013}$ ±0.0055	2719	[38] AKERS 93B	OPAL	$e^+e^- \to Z$
0.138 ±0.032 ±0.008		[39] ADEVA 91C	L3	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.086 ±0.027 ±0.008		[40] ABE 93E	VNS	$E^{ee}_{\rm cm}$= 58 GeV
0.111 ±0.028 ±0.026		BEHREND 90D	CELL	$E^{ee}_{\rm cm}$= 43 GeV
0.150 ±0.011 ±0.022		BEHREND 90D	CELL	$E^{ee}_{\rm cm}$= 35 GeV
0.112 ±0.009 ±0.011		ONG 88	MRK2	$E^{ee}_{\rm cm}$= 29 GeV
0.149 $^{+0.022}_{-0.019}$		PAL 86	DLCO	$E^{ee}_{\rm cm}$= 29 GeV
0.110 ±0.018 ±0.010		AIHARA 85	TPC	$E^{ee}_{\rm cm}$= 29 GeV
0.111 ±0.034 ±0.040		ALTHOFF 84J	TASS	$E^{ee}_{\rm cm}$= 34.6 GeV
0.146 ±0.028		KOOP 84	DLCO	Repl. by PAL 86
0.116 ±0.021 ±0.017		NELSON 83	MRK2	$E^{ee}_{\rm cm}$= 29 GeV

OCCUR=2

[35] ACCIARRI 96C result obtained by a fit to the single lepton spectrum. NODE=S051S1;LINKAGE=MS

[36] Assumes Standard Model value for R_B. NODE=S051S1;LINKAGE=SM

[37] ABREU 93C event count includes ee events. Combining ee, $\mu\mu$, and $e\mu$ events, they obtain 0.100 ± 0.007 ± 0.007. NODE=S051S1;LINKAGE=G

[38] AKERS 93B analysis performed using single and dilepton events. NODE=S051S1;LINKAGE=H

[39] ADEVA 91C measure the average B($b \to eX$) branching ratio using single and double tagged b enhanced Z events. Combining e and μ results, they obtain 0.113 ± 0.010 ± 0.006. Constraining the initial number of b quarks by the Standard Model prediction (378 ± 3 MeV) for the decay of the Z into $b\overline{b}$, the electron result gives 0.112 ± 0.004 ± 0.008. They obtain 0.119 ± 0.003 ± 0.006 when e and μ results are combined. Used to measure the $b\overline{b}$ width itself, this electron result gives 370 ± 12 ± 24 MeV and combined with the muon result gives 385 ± 7 ± 22 MeV. NODE=S051S1;LINKAGE=E

[40] ABE 93E experiment also measures forward-backward asymmetries and fragmentation functions for b and c. NODE=S051S1;LINKAGE=F

$\Gamma(\mu^+ \nu_\mu \text{anything})/\Gamma_{total}$ Γ_9/Γ

NODE=S051S2
NODE=S051S2

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

NODE=S051S2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.				
0.108 ±0.005 OUR AVERAGE				
0.1082±0.0015±0.0059		[41,42] ACCIARRI	96C L3	$e^+e^- \rightarrow Z$
0.110 ±0.012 ±0.007	656	[43] ABREU	93C DLPH	$e^+e^- \rightarrow Z$
0.101 $^{+0.010}_{-0.009}$ ±0.0055	4248	[44] AKERS	93B OPAL	$e^+e^- \rightarrow Z$
0.113 ±0.012 ±0.006		[45] ADEVA	91C L3	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.122 ±0.006 ±0.007		[42] UENO	96 AMY	e^+e^- at 57.9 GeV
0.104 ±0.023 ±0.016		BEHREND	90D CELL	E^{ee}_{cm}= 43 GeV
0.148 ±0.010 ±0.016		BEHREND	90D CELL	E^{ee}_{cm}= 35 GeV
0.118 ±0.012 ±0.010		ONG	88 MRK2	E^{ee}_{cm}= 29 GeV
0.117 ±0.016 ±0.015		BARTEL	87 JADE	E^{ee}_{cm}= 34.6 GeV
0.114 ±0.018 ±0.025		BARTEL	85J JADE	Repl. by BARTEL 87
0.117 ±0.028 ±0.010		ALTHOFF	84G TASS	E^{ee}_{cm}= 34.5 GeV
0.105 ±0.015 ±0.013		ADEVA	83B MRKJ	E^{ee}_{cm}= 33–38.5 GeV
0.155 $^{+0.054}_{-0.029}$		FERNANDEZ	83D MAC	E^{ee}_{cm}= 29 GeV

OCCUR=2

[41] ACCIARRI 96C result obtained by a fit to the single lepton spectrum. NODE=S051S2;LINKAGE=MS

[42] Assumes Standard Model value for R_B. NODE=S051S2;LINKAGE=SM

[43] ABREU 93C event count includes $\mu\mu$ events. Combining ee, $\mu\mu$, and $e\mu$ events, they obtain 0.100 ± 0.007 ± 0.007. NODE=S051S2;LINKAGE=G

[44] AKERS 93B analysis performed using single and dilepton events. NODE=S051S2;LINKAGE=B

[45] ADEVA 91C measure the average B($b \rightarrow eX$) branching ratio using single and double tagged b enhanced Z events. Combining e and μ results, they obtain 0.113 ± 0.010 ± 0.006. Constraining the initial number of b quarks by the Standard Model prediction (378±3 MeV) for the decay of the Z into $b\overline{b}$, the muon result gives 0.123±0.003±0.006. They obtain 0.119 ± 0.003 ± 0.006 when e and μ results are combined. Used to measure the $b\overline{b}$ width itself, this muon result gives 394 ± 9 ± 22 MeV and combined with the electron result gives 385 ± 7 ± 22 MeV. NODE=S051S2;LINKAGE=E

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

NODE=S051R15
NODE=S051R15

VALUE	DOCUMENT ID	TECN	COMMENT
0.0202±0.0026±0.0013	[46] AKERS	95Q OPAL	$e^+e^- \rightarrow Z$

[46] AKERS 95Q reports [B($\overline{b} \rightarrow D^- \ell^+ \nu_\ell$ anything) × B($D^+ \rightarrow K^- \pi^+ \pi^+$)] = (1.82 ± 0.20 ± 0.12)×10^{-3}. We divide by our best value B($D^+ \rightarrow K^- \pi^+ \pi^+$) = (9.0 ± 0.6)× 10^{-2}. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=S051R15;LINKAGE=A

$\Gamma(\overline{D}^0 \ell^+ \nu_\ell \text{anything})/\Gamma_{total}$ Γ_{11}/Γ

NODE=S051R16
NODE=S051R16

VALUE	DOCUMENT ID	TECN	COMMENT
0.066±0.006 OUR NEW AVERAGE	[0.065 ± 0.006 OUR 1998 AVERAGE]		
0.066±0.006±0.002	[47] AKERS	95Q OPAL	$e^+e^- \rightarrow Z$

[47] AKERS 95Q reports [B($\overline{b} \rightarrow \overline{D}^0 \ell^+ \nu_\ell$ anything) × B($D^0 \rightarrow K^- \pi^+$)] = (2.52 ± 0.14 ± 0.17) × 10^{-3}. We divide by our best value B($D^0 \rightarrow K^- \pi^+$) = (3.83 ± 0.09) × 10^{-2}. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=S051R16;LINKAGE=A

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

NODE=S051R17
NODE=S051R17

VALUE	DOCUMENT ID	TECN	COMMENT
0.0276±0.0027±0.0011	[48] AKERS	95Q OPAL	$e^+e^- \rightarrow Z$

[48] AKERS 95Q reports [B($\overline{b} \rightarrow D^* \ell^+ \nu_\ell X$) × B($D^{*+} \rightarrow D^0 \pi^+$) × B($D^0 \rightarrow K^- \pi^+$)] = ((7.53 ± 0.47 ± 0.56) × 10^{-4}) and uses B($D^{*+} \rightarrow D^0 \pi^+$) = 0.681 ± 0.013 and B($D^0 \rightarrow K^- \pi^+$) = 0.0401 ± 0.0014 to obtain the above result. The first error is the experiments error and the second error is the systematic error from the D^{*+} and D^0 branching ratios. NODE=S051R17;LINKAGE=A

$\Gamma(\overline{D}^0_j \ell^+ \nu_\ell \text{anything})/\Gamma_{total}$ Γ_{13}/Γ

NODE=S051R18

D_j represents an unresolved mixture of pseudoscalar and tensor D^{**} (P-wave) states.

NODE=S051R18
NODE=S051R18

VALUE	DOCUMENT ID	TECN	COMMENT
seen	[49] AKERS	95Q OPAL	$e^+e^- \rightarrow Z$

[49] AKERS 95Q quotes the product branching ratio B($\overline{b} \rightarrow \overline{D}^0_j \ell^+ \nu_\ell X$) B($\overline{D}^0_j \rightarrow D^{*+} \pi^-$) = ((6.1 ± 1.3 ± 1.3) × 10^{-3}). NODE=S051R18;LINKAGE=A

$\Gamma(D_j^- \ell^+ \nu_\ell \text{anything})/\Gamma_{total}$ — Γ_{14}/Γ

NODE=S051R19

D_j represents an unresolved mixture of pseudoscalar and tensor D^{**} (P-wave) states.

NODE=S051R19
NODE=S051R19

VALUE	DOCUMENT ID	TECN	COMMENT
seen	[50] AKERS 95Q	OPAL	$e^+e^- \to Z$

[50] AKERS 95Q quotes the product branching ratio B($\overline{b} \to D_j^- \ell^+ \nu_\ell$anything) B($D_j^- \to D^0 \pi^-$) = ($(7.0 \pm 1.9^{+1.2}_{-1.3}) \times 10^{-3}$). NODE=S051R19;LINKAGE=A

$\Gamma(\overline{D}_2^*(2460)^0 \ell^+ \nu_\ell \text{anything})/\Gamma_{total}$ — Γ_{15}/Γ

NODE=S051R21
NODE=S051R21

VALUE	DOCUMENT ID	TECN	COMMENT
seen	[51] AKERS 95Q	OPAL	$e^+e^- \to Z$

[51] AKERS 95Q quotes the product branching ratio B($\overline{b} \to \overline{D}_2^*(2460)^0 \ell^+ \nu_\ell$anything) B($D_2^*(2460)^0 \to D^+ \pi^-$) = $(1.6 \pm 0.7 \pm 0.3) \times 10^{-3}$. NODE=S051R21;LINKAGE=A

$\Gamma(D_2^*(2460)^- \ell^+ \nu_\ell \text{anything})/\Gamma_{total}$ — Γ_{16}/Γ

NODE=S051R22
NODE=S051R22

VALUE	DOCUMENT ID	TECN	COMMENT
seen	[52] AKERS 95Q	OPAL	$e^+e^- \to Z$

[52] AKERS 95Q quotes the product branching ratio B($\overline{b} \to D_2^*(2460) \ell^+ \nu_\ell$anything) B($D_2^*(2460)^+ \to D^0 \pi^-$) = $4.2 \pm 1.3^{+0.7}_{-1.2}$. NODE=S051R22;LINKAGE=A

$\Gamma(\text{charmless } \ell \overline{\nu}_\ell)/\Gamma_{total}$ — Γ_{17}/Γ

NODE=S051R31
NODE=S051R31

VALUE	DOCUMENT ID	TECN	COMMENT
0.0019 ±0.0007 OUR AVERAGE			
0.00173±0.00055±0.00055	[53] BARATE 99G	ALEP	$e^+e^- \to Z$
0.0033 ±0.0010 ±0.0017	[54] ACCIARRI 98K	L3	$e^+e^- \to Z$

[53] Uses lifetime tagged $b\overline{b}$ sample. NODE=S051R31;LINKAGE=B
[54] ACCIARRI 98K assumes R_b= 0.2174 ± 0.0009 at Z decay. NODE=S051R31;LINKAGE=A

$\Gamma(\tau^+ \nu_\tau \text{anything})/\Gamma_{total}$ — Γ_{18}/Γ

NODE=S051S46
NODE=S051S46

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6 ±0.4 OUR AVERAGE				
1.7 ±0.5 ±1.1		[55,56] ACCIARRI 96C	L3	$e^+e^- \to Z$
2.75±0.30±0.37	405	[57] BUSKULIC 95	ALEP	$e^+e^- \to Z$
2.4 ±0.7 ±0.8	1032	[58] ACCIARRI 94C	L3	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.08±0.76±0.62		BUSKULIC 93B	ALEP	Repl. by BUSKULIC 95

[55] ACCIARRI 96C result obtained from missing energy spectrum. NODE=S051S46;LINKAGE=MS
[56] Assumes Standard Model value for R_B. NODE=S051S46;LINKAGE=SM
[57] BUSKULIC 95 uses missing-energy technique. NODE=S051S46;LINKAGE=B
[58] This is a direct result using tagged $b\overline{b}$ events at the Z, but species are not separated. NODE=S051S46;LINKAGE=A

$\Gamma(\overline{b} \to \overline{c} \to \ell^- \overline{\nu}_\ell \text{anything})/\Gamma_{total}$ — Γ_{19}/Γ

NODE=S051S94
NODE=S051S94

VALUE	DOCUMENT ID	TECN	COMMENT
0.078 ±0.006 OUR AVERAGE			
0.0770±0.0097±0.0046	[59] ABREU 95D	DLPH	$e^+e^- \to Z$
0.082 ±0.003 ±0.012	[60] BUSKULIC 94G	ALEP	$e^+e^- \to Z$
0.077 ±0.004 ±0.007	[61] AKERS 93B	OPAL	$e^+e^- \to Z$

[59] ABREU 95D give systematic errors ±0.0033 (model) and 0.0032 (R_c). We combine these in quadrature. This result is from the same global fit as their $\Gamma(\overline{b} \to \ell^+ \nu_\ell X)$ data. NODE=S051S94;LINKAGE=B
[60] BUSKULIC 94G uses e and μ events. This value is from the same global fit as their $\Gamma(\overline{b} \to \ell^+ \nu_\ell \text{anything})/\Gamma_{total}$ data. NODE=S051S94;LINKAGE=A
[61] AKERS 93B analysis performed using single and dilepton events. NODE=S051S94;LINKAGE=SB

$\Gamma(\overline{D}^0 \text{anything})/\Gamma_{total}$ — Γ_{20}/Γ

NODE=S051R24
NODE=S051R24

VALUE	DOCUMENT ID	TECN	COMMENT
0.605±0.032 OUR NEW AVERAGE [0.601 ± 0.032 OUR 1998 AVERAGE]			
0.605±0.029±0.014	[62] BUSKULIC 96Y	ALEP	$e^+e^- \to Z$

[62] BUSKULIC 96Y reports 0.605 ± 0.024 ± 0.016 for B($D^0 \to K^- \pi^+$) = 0.0383. We rescale to our best value B($D^0 \to K^- \pi^+$) = $(3.83 \pm 0.09) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=S051R24;LINKAGE=A

$\Gamma(D^0 D_s^{\pm}\,\text{anything})/\Gamma_{\text{total}}$ Γ_{21}/Γ

NODE=S051R51
NODE=S051R51

VALUE	DOCUMENT ID	TECN	COMMENT
$0.091^{+0.020+0.034}_{-0.018-0.022}$	[63] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

NODE=S051R51;LINKAGE=A

$\Gamma(D^{\mp} D_s^{\pm}\,\text{anything})/\Gamma_{\text{total}}$ Γ_{22}/Γ

NODE=S051R52
NODE=S051R52

VALUE	DOCUMENT ID	TECN	COMMENT
$0.040^{+0.017+0.016}_{-0.014-0.011}$	[64] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

NODE=S051R52;LINKAGE=A

$[\Gamma(D^0 D_s^{\pm}\,\text{anything}) + \Gamma(D^{\mp} D_s^{\pm}\,\text{anything})]/\Gamma_{\text{total}}$ $(\Gamma_{21}+\Gamma_{22})/\Gamma$

NODE=S051R53
NODE=S051R53

VALUE	DOCUMENT ID	TECN	COMMENT
$0.131^{+0.026+0.048}_{-0.022-0.031}$	[65] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

NODE=S051R53;LINKAGE=A

$\Gamma(\overline{D}^0 D^0\,\text{anything})/\Gamma_{\text{total}}$ Γ_{23}/Γ

NODE=S051R47
NODE=S051R47

VALUE	DOCUMENT ID	TECN	COMMENT
$0.051^{+0.016+0.012}_{-0.014-0.011}$	[66] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

NODE=S051R47;LINKAGE=A

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

NODE=S051R48
NODE=S051R48

VALUE	DOCUMENT ID	TECN	COMMENT
$0.027^{+0.015+0.010}_{-0.013-0.009}$	[67] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

NODE=S051R48;LINKAGE=A

$[\Gamma(\overline{D}^0 D^0\,\text{anything}) + \Gamma(D^0 D^{\pm}\,\text{anything})]/\Gamma_{\text{total}}$ $(\Gamma_{23}+\Gamma_{24})/\Gamma$

NODE=S051R50
NODE=S051R50

VALUE	DOCUMENT ID	TECN	COMMENT
$0.078^{+0.020+0.018}_{-0.018-0.016}$	[68] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

NODE=S051R50;LINKAGE=A

$\Gamma(D^{\pm} D^{\mp}\,\text{anything})/\Gamma_{\text{total}}$ Γ_{25}/Γ

NODE=S051R49
NODE=S051R49

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.009	90	BARATE 98Q	ALEP	$e^+e^- \to Z$

$\Gamma(D^-\,\text{anything})/\Gamma_{\text{total}}$ Γ_{26}/Γ

NODE=S051R25
NODE=S051R25

VALUE	DOCUMENT ID	TECN	COMMENT
$0.237\pm0.017\pm0.015$	[69] BUSKULIC 96Y	ALEP	$e^+e^- \to Z$

[69] BUSKULIC 96Y reports $0.234 \pm 0.013 \pm 0.010$ for $B(D^+ \to K^-\pi^+\pi^+) = 0.091$. We rescale to our best value $B(D^+ \to K^-\pi^+\pi^+) = (9.0 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=S051R25;LINKAGE=A

$\Gamma(D^*(2010)^+\,\text{anything})/\Gamma_{\text{total}}$ Γ_{27}/Γ

NODE=S051R46
NODE=S051R46

VALUE	DOCUMENT ID	TECN	COMMENT
$0.173\pm0.016\pm0.012$	[70] ACKERSTAFF 98E	OPAL	$e^+e^- \to Z$

[70] Uses lepton tags to select $Z \to b\overline{b}$ events.

NODE=S051R46;LINKAGE=A

$\Gamma(D_1(2420)^0\,\text{anything})/\Gamma_{\text{total}}$ Γ_{28}/Γ

NODE=S051R32
NODE=S051R32

VALUE	DOCUMENT ID	TECN	COMMENT
$0.050\pm0.014\pm0.006$	[71] ACKERSTAFF 97W	OPAL	$e^+e^- \to Z$

[71] ACKERSTAFF 97W assumes $B(D_2^*(2460)^0 \to D^{*+}\pi^-) = 0.21 \pm 0.04$ and $\Gamma_{b\overline{b}}/\Gamma_{\text{hadrons}} = 0.216$ at Z decay.

NODE=S051R32;LINKAGE=A

$\Gamma(D^*(2010)^{\mp} D_s^{\pm}\,\text{anything})/\Gamma_{\text{total}}$ Γ_{29}/Γ

NODE=S051R54
NODE=S051R54

VALUE	DOCUMENT ID	TECN	COMMENT
$0.033^{+0.010+0.012}_{-0.009-0.009}$	[72] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

NODE=S051R54;LINKAGE=A

$\Gamma(D^0 D^*(2010)^{\pm}\text{ anything})/\Gamma_{total}$ — Γ_{30}/Γ

NODE=S051R55
NODE=S051R55

VALUE	DOCUMENT ID	TECN	COMMENT
$0.030^{+0.009+0.007}_{-0.008-0.005}$	[73] BARATE 98Q	ALEP	$e^+e^- \rightarrow Z$

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

NODE=S051R55;LINKAGE=A

$\Gamma(D^*(2010)^{\pm} D^{\mp}\text{ anything})/\Gamma_{total}$ — Γ_{31}/Γ

NODE=S051R56
NODE=S051R56

VALUE	DOCUMENT ID	TECN	COMMENT
$0.025^{+0.010+0.006}_{-0.009-0.005}$	[74] BARATE 98Q	ALEP	$e^+e^- \rightarrow Z$

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

NODE=S051R56;LINKAGE=A

$\Gamma(D^*(2010)^{\pm} D^*(2010)^{\mp}\text{ anything})/\Gamma_{total}$ — Γ_{32}/Γ

NODE=S051R57
NODE=S051R57

VALUE	DOCUMENT ID	TECN	COMMENT
$0.012^{+0.004}_{-0.003}\pm0.002$	[75] BARATE 98Q	ALEP	$e^+e^- \rightarrow Z$

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

NODE=S051R57;LINKAGE=A

$\Gamma(D_2^*(2460)^0\text{ anything})/\Gamma_{total}$ — Γ_{33}/Γ

NODE=S051R33
NODE=S051R33

VALUE	DOCUMENT ID	TECN	COMMENT
0.047±0.024±0.013	[76] ACKERSTAFF 97W	OPAL	$e^+e^- \rightarrow Z$

[76] ACKERSTAFF 97W assumes $B(D_2^*(2460)^0 \rightarrow D^{*+}\pi^-) = 0.21 \pm 0.04$ and $\Gamma_{b\overline{b}}/\Gamma_{hadrons} = 0.216$ at Z decay.

NODE=S051R33;LINKAGE=A

$\Gamma(\overline{D}_s\text{ anything})/\Gamma_{total}$ — Γ_{34}/Γ

NODE=S051R26
NODE=S051R26

VALUE	DOCUMENT ID	TECN	COMMENT
0.18±0.02±0.04	[77] BUSKULIC 96Y	ALEP	$e^+e^- \rightarrow Z$

[77] BUSKULIC 96Y reports $0.183 \pm 0.019 \pm 0.009$ for $B(D_s^+ \rightarrow \phi\pi^+) = 0.036$. We rescale to our best value $B(D_s^+ \rightarrow \phi\pi^+) = (3.6 \pm 0.9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=S051R26;LINKAGE=A

$\Gamma(b \rightarrow \Lambda_c\text{ anything})/\Gamma_{total}$ — Γ_{35}/Γ

NODE=S051R27
NODE=S051R27

VALUE	DOCUMENT ID	TECN	COMMENT
0.097±0.013±0.025	[78] BUSKULIC 96Y	ALEP	$e^+e^- \rightarrow Z$

[78] BUSKULIC 96Y reports $0.110 \pm 0.014 \pm 0.006$ for $B(\Lambda_c^+ \rightarrow pK^-\pi^+) = 0.044$. We rescale to 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.

NODE=S051R27;LINKAGE=A

$\Gamma(\overline{c}/c\text{ anything})/\Gamma_{total}$ — Γ_{36}/Γ

NODE=S051R28
NODE=S051R28

VALUE	DOCUMENT ID	TECN	COMMENT
1.17 ±0.04 OUR AVERAGE			
1.147±0.041	[79] ABREU 98D	DLPH	$e^+e^- \rightarrow Z$
1.230±0.036±0.065	[80] BUSKULIC 96Y	ALEP	$e^+e^- \rightarrow Z$

[79] ABREU 98D results are extracted from a fit to the b-tagging probablility distribution based on the impact parameter.

NODE=S051R28;LINKAGE=B

[80] BUSKULIC 96Y assumes PDG 96 production fractions for B^0, B^+, B_s, b baryons, and PDG 96 branching ratios for charm decays. This is sum of their inclusive $\overline{D}^0$, D^-, $\overline{D}_s$, and Λ_c branching ratios, corrected to include inclusive Ξ_c and charmonium.

NODE=S051R28;LINKAGE=A

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

NODE=S051S7
NODE=S051S7

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.16±0.10 OUR AVERAGE					
1.12±0.12±0.10			[81] ABREU 94P	DLPH	$e^+e^- \rightarrow Z$
1.16±0.16±0.14		121	[82] ADRIANI 93J	L3	$e^+e^- \rightarrow Z$
1.21±0.13±0.08			BUSKULIC 92G	ALEP	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.3 ±0.2 ±0.2			[83] ADRIANI 92	L3	$e^+e^- \rightarrow Z$
<4.9	90		MATTEUZZI 83	MRK2	E_{cm}^{ee}= 29 GeV

[81] ABREU 94P is an inclusive measurement from b decays at the Z. Uses $J/\psi(1S) \rightarrow e^+e^-$ and $\mu^+\mu^-$ channels. Assumes $\Gamma(Z \rightarrow b\overline{b})/\Gamma_{hadron}$=0.22.

NODE=S051S7;LINKAGE=E

[82] ADRIANI 93J is an inclusive measurement from b decays at the Z. Uses $J/\psi(1S) \rightarrow \mu^+\mu^-$ and $J/\psi(1S) \rightarrow e^+e^-$ channels.

NODE=S051S7;LINKAGE=D

[83] ADRIANI 92 measurement is an inclusive result for $B(Z \rightarrow J/\psi(1S)X) = (4.1 \pm 0.7 \pm 0.3) \times 10^{-3}$ which is used to extract the b-hadron contribution to $J/\psi(1S)$ production.

NODE=S051S7;LINKAGE=CC

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

NODE=S051S25
NODE=S051S25

VALUE	DOCUMENT ID	TECN	COMMENT
0.0048±0.0022±0.0010	[84] ABREU 94P	DLPH	$e^+e^- \to Z$

[84] ABREU 94P is an inclusive measurement from b decays at the Z. Uses $\psi(2S) \to J/\psi(1S)\pi^+\pi^-$, $J/\psi(1S) \to \mu^+\mu^-$ channels. Assumes $\Gamma(Z \to b\overline{b})/\Gamma_{\text{hadron}}$=0.22.

NODE=S051S25;LINKAGE=E

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

NODE=S051R89
NODE=S051R89

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.018±0.005 OUR AVERAGE				
$0.014\pm0.006^{+0.004}_{-0.002}$		[85] ABREU 94P	DLPH	$e^+e^- \to Z$
0.024±0.009±0.002	19	[86] ADRIANI 93J	L3	$e^+e^- \to Z$

[85] ABREU 94P is an inclusive measurement from b decays at the Z. Uses $\chi_{c1}(1P) \to J/\psi(1S)\gamma$, $J/\psi(1S) \to \mu^+\mu^-$ channels. Assumes no $\chi_{c2}(1P)$ and $\Gamma(Z \to b\overline{b})/\Gamma_{\text{hadron}}$=0.22.

NODE=S051R89;LINKAGE=E

[86] ADRIANI 93J is an inclusive measurement and assumes χ_{c1} come from b decays at Z. Uses $J/\psi(1S) \to \mu^+\mu^-$ channel.

NODE=S051R89;LINKAGE=B

$\Gamma(\chi_{c1}(1P)\text{anything})/\Gamma(J/\psi(1S)\text{anything})$ Γ_{39}/Γ_{37}

NODE=S051S59
NODE=S051S59

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.92±0.82	121	[87] ADRIANI 93J	L3	$e^+e^- \to Z$

[87] ADRIANI 93J is a ratio of inclusive measurements from b decays at the Z using only the $J/\psi(1S) \to \mu^+\mu^-$ channel since some systematics cancel.

NODE=S051S59;LINKAGE=A

$\Gamma(\overline{s}\gamma)/\Gamma_{\text{total}}$ Γ_{40}/Γ

NODE=S051S58
NODE=S051S58

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
3.11±0.80±0.72		[88] BARATE 98I	ALEP	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<$ 5.4	90	[89] ADAM 96D	DLPH	$e^+e^- \to Z$
$<$12	90	[90] ADRIANI 93L	L3	$e^+e^- \to Z$

[88] BARATE 98I uses liftime tagged $Z \to b\overline{b}$ sample.

NODE=S051S58;LINKAGE=B

[89] ADAM 96D assumes $f_{B^0} = f_{B^-} = 0.39$ and $f_{B_s} = 0.12$.

NODE=S051S58;LINKAGE=DQ

[90] ADRIANI 93L result is for $\overline{b} \to \overline{s}\gamma$ is performed inclusively.

NODE=S051S58;LINKAGE=A

$\Gamma(K^\pm\text{anything})/\Gamma_{\text{total}}$ Γ_{41}/Γ

NODE=S051R10
NODE=S051R10

VALUE	DOCUMENT ID	TECN	COMMENT
0.74±0.06 OUR NEW AVERAGE	[0.88 ± 0.19 OUR 1998 AVERAGE]		
0.72±0.02±0.06	BARATE 98V	ALEP	$e^+e^- \to Z$
0.88±0.05±0.18	ABREU 95C	DLPH	$e^+e^- \to Z$

$\Gamma(K^0_S\text{anything})/\Gamma_{\text{total}}$ Γ_{42}/Γ

NODE=S051R11
NODE=S051R11

VALUE	DOCUMENT ID	TECN	COMMENT
0.290±0.011±0.027	ABREU 95C	DLPH	$e^+e^- \to Z$

$\Gamma(\pi^\pm\text{anything})/\Gamma_{\text{total}}$ Γ_{43}/Γ

NODE=S051R34
NODE=S051R34

VALUE	DOCUMENT ID	TECN	COMMENT
3.97±0.02±0.21	BARATE 98V	ALEP	$e^+e^- \to Z$

$\Gamma(\pi^0\text{anything})/\Gamma_{\text{total}}$ Γ_{44}/Γ

NODE=S051R5
NODE=S051R5

VALUE	DOCUMENT ID	TECN	COMMENT
2.78±0.15±0.60	[91] ADAM 96	DLPH	$e^+e^- \to Z$

[91] ADAM 96 measurement obtained from a fit to the rapidity distribtuion of $\pi^{0's}$ in $Z \to b\,b$ events.

NODE=S051R5;LINKAGE=A

$\Gamma(p/\overline{p}\text{anything})/\Gamma_{\text{total}}$ Γ_{45}/Γ

NODE=S051R12
NODE=S051R12

VALUE	DOCUMENT ID	TECN	COMMENT
0.131±0.011 OUR NEW AVERAGE	[0.14 ± 0.06 OUR 1998 AVERAGE]		
0.131±0.004±0.011	BARATE 98V	ALEP	$e^+e^- \to Z$
0.141±0.018±0.056	ABREU 95C	DLPH	$e^+e^- \to Z$

NODE=S051R14
NODE=S051R14

$\Gamma(\text{charged anything})/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE		DOCUMENT ID	TECN	COMMENT
4.97±0.03±0.06	[92]	ABREU 98H	DLPH	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.84±0.04±0.38		ABREU 95C	DLPH	Repl. by ABREU 98H

[92] ABREU 98H measurement excludes the contribution from K^0 and Λ decay.

NODE=S051R14;LINKAGE=A

NODE=S051R29
NODE=S051R29

$\Gamma(\text{hadron}^+\ \text{hadron}^-)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-5})		DOCUMENT ID	TECN	COMMENT
$\mathbf{1.7^{+1.0}_{-0.7}\pm0.2}$	[93,94]	BUSKULIC 96V	ALEP	$e^+e^- \to Z$

[93] BUSKULIC 96V assumes PDG 96 production fractions for B^0, B^+, B_s, b baryons.

NODE=S051R29;LINKAGE=BV

[94] Average branching fraction of weakly decaying B hadrons into two long-lived charged hadrons, weighted by their production cross section and lifetimes.

NODE=S051R29;LINKAGE=CV

NODE=S051R7
NODE=S051R7

$\Gamma(\text{charmless})/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE		DOCUMENT ID	TECN	COMMENT
0.007±0.021	[95]	ABREU 98D	DLPH	$e^+e^- \to Z$

[95] ABREU 98D results are extracted from a fit to the b-tagging probablility distribution based on the impact parameter. The expected hidden charm contribution of 0.026±0.004 has been subtracted.

NODE=S051R7;LINKAGE=B

NODE=S051R13
NODE=S051R13

$\Gamma(\Lambda/\overline{\Lambda}\text{anything})/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.059 ±0.006 OUR AVERAGE			
0.0587±0.0046±0.0048	ACKERSTAFF 97N	OPAL	$e^+e^- \to Z$
0.059 ±0.007 ±0.009	ABREU 95C	DLPH	$e^+e^- \to Z$

NODE=S051R35
NODE=S051R35

$\Gamma(b\text{-baryon anything})/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE		DOCUMENT ID	TECN	COMMENT
0.102±0.007±0.027	[96]	BARATE 98V	ALEP	$e^+e^- \to Z$

[96] BARATE 98V assumes B($B_s \to pX$) = 8 ± 4% and B(b-baryon $\to pX$) = 58 ± 6%.

NODE=S051R35;LINKAGE=A

NODE=S051S4

$\Gamma(\mu^+\mu^-\ \text{anything})/\Gamma_{\text{total}}$ Γ_{52}/Γ

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

NODE=S051S4
NODE=S051S4

VALUE	CL%		DOCUMENT ID	TECN	COMMENT
$\mathbf{<3.2 \times 10^{-4}}$	90		ABBOTT 98B	D0	$p\overline{p}$ 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<5.0 \times 10^{-5}$	90	[97]	ALBAJAR 91C	UA1	$E^{p\overline{p}}_{\text{cm}}$= 630 GeV
<0.02	95		ALTHOFF 84G	TASS	E^{ee}_{cm}= 34.5 GeV
<0.007	95		ADEVA 83	MRKJ	E^{ee}_{cm}= 30–38 GeV
<0.007	95		BARTEL 83B	JADE	E^{ee}_{cm}= 33–37 GeV

[97] Both ABBOTT 98B and GLENN 98 claim that the efficiency quoted in ALBAJAR 91C was overestimated by a large factor.

NODE=S051S4;LINKAGE=B

NODE=S051S5

$\left[\Gamma(e^+e^-\ \text{anything}) + \Gamma(\mu^+\mu^-\ \text{anything})\right]/\Gamma_{\text{total}}$ $(\Gamma_{51}+\Gamma_{52})/\Gamma$

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

NODE=S051S5
NODE=S051S5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.008	90	MATTEUZZI 83	MRK2	E^{ee}_{cm}= 29 GeV

NODE=S051R20
NODE=S051R20

$\Gamma(\nu\overline{\nu}\text{anything})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE		DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<3.9 \times 10^{-4}$	[98]	GROSSMAN 96	RVUE	$e^+e^- \to Z$

[98] GROSSMAN 96 limit is derived from the ALEPH BUSKULIC 95 limit B($B^+ \to \tau^+\nu_\tau$) $< 1.8 \times 10^{-3}$ at CL=90% using conservative simplifying assumptions.

NODE=S051R20;LINKAGE=A

$B^{\pm}/B^{0}/B^{0}_{s}/b$-baryon ADMIXTURE REFERENCES

NODE=S051

ABBIENDI	99J	hep-ex/9901017	G. Abbiendi+	(OPAL Collab.)	REFID=46738
CERN-EP/98-195, EPJ C (to be publ.)					
BARATE	99G	EPJ C6 555	R. Barate+	(ALEPH Collab.)	REFID=46720
ABBOTT	98B	PL B423 419	B. Abbott+	(D0 Collab.)	REFID=45868
ABE	98B	PR D57 5382	F. Abe+	(CDF Collab.)	REFID=45880
ABREU	98D	PL B426 193	P. Abreu+	(DELPHI Collab.)	REFID=45876
ABREU	98H	PL B425 399	P. Abreu+	(DELPHI Collab.)	REFID=45933
ACCIARRI	98	PL B416 220	M. Acciarri+	(L3 Collab.)	REFID=45831
ACCIARRI	98K	PL B436 174	M. Acciarri+	(L3 Collab.)	REFID=46158
ACKERSTAFF	98E	EPJ C1 439	K. Ackerstaff+	(OPAL Collab.)	REFID=45837
BARATE	98I	PL B429 169	R. Barate+	(ALEPH Collab.)	REFID=46061
BARATE	98Q	EPJ C4 387	R. Barate+	(ALEPH Collab.)	REFID=46146
BARATE	98V	EPJ C5 205	R. Barate+	(ALEPH Collab.)	REFID=46151
GLENN	98	PRL 80 2289	S. Glenn+	(CLEO Collab.)	REFID=45869
ACKERSTAFF	97F	ZPHY C73 397	+Alexander, Allison, Ametewee+	(OPAL Collab.)	REFID=45414
ACKERSTAFF	97N	ZPHY C74 423	K. Ackerstaff+	(OPAL Collab.)	REFID=45488
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff+	(OPAL Collab.)	REFID=45788
ABREU	96E	PL B377 195	+Adam, Adye, Agasi+	(DELPHI Collab.)	REFID=44701
ACCIARRI	96C	ZPHY C71 379	+Adam, Adriani, Aguilar-Benitez+	(L3 Collab.)	REFID=44826
ADAM	96	ZPHY C69 561	+Adye, Agasi, Ajinenko+	(DELPHI Collab.)	REFID=44627
ADAM	96D	ZPHY C72 207	W. Adam+	(DELPHI Collab.)	REFID=45276
BUSKULIC	96F	PL B369 151	+Casper, De Bonis, Decamp+	(ALEPH Collab.)	REFID=44690
BUSKULIC	96V	PL B384 471	+De Bonis, Decamp, Ghez+	(ALEPH Collab.)	REFID=44909
BUSKULIC	96Y	PL B388 648	+De Bonis, Decamp, Ghez+	(ALEPH Collab.)	REFID=44963
GROSSMAN	96	NP B465 369	+Ligeti, Nardi	(REHO, CIT)	REFID=44692
Also	96B	NP B480 753 (erratum)			REFID=45344
PDG	96	PR D54 1			REFID=44495
UENO	96	PL B381 365	+Kanda, Olsen, Kirk+	(AMY Collab.)	REFID=44850
ABE,K	95B	PRL 75 3624	Abe, Abt, Ahn, Akagi+	(SLD Collab.)	REFID=44550
ABREU	95C	PL B347 447	+Adam, Adye, Agasi+	(DELPHI Collab.)	REFID=44210
ABREU	95D	ZPHY C66 323	+Adam, Adye, Agasi+	(DELPHI Collab.)	REFID=44261
ADAM	95	ZPHY C68 363	+Adye, Agasi, Ajinenko+	(DELPHI Collab.)	REFID=44465
AKERS	95Q	ZPHY C67 57	+Alexander, Allison, Ametewee+	(OPAL Collab.)	REFID=44367
BUSKULIC	95	PL B343 444	+Casper, De Bonis, Decamp, Ghez, Goy+	(ALEPH Collab.)	REFID=44119
ABREU	94L	ZPHY C63 3	+Adam, Adye, Agasi, Aleksan+	(DELPHI Collab.)	REFID=43995
ABREU	94P	PL B341 109	+Adam, Adye, Agasi, Ajinenko+	(DELPHI Collab.)	REFID=44067
ACCIARRI	94C	PL B332 201	+Adam, Adriani, Aguilar-Benitez, Ahlen+	(L3 Collab.)	REFID=43897
BUSKULIC	94G	ZPHY C62 179	+Casper, De Bonis, Decamp, Ghez+	(ALEPH Collab.)	REFID=43911
ABE	93E	PL B313 288	+Amako, Arai, Arima, Asano+	(VENUS Collab.)	REFID=43491
ABE	93J	PRL 71 3421	+Albrow, Amidei, Anway-Wiese+	(CDF Collab.)	REFID=43576
ABREU	93C	PL B301 145	+Adam, Adye, Agasi, Aleksan+	(DELPHI Collab.)	REFID=43236
ABREU	93D	ZPHY C57 181	+Adam, Adye, Agasi, Alekseev+	(DELPHI Collab.)	REFID=43267
ABREU	93G	PL B312 253	+Adam, Adye, Agasi, Ajinenko+	(DELPHI Collab.)	REFID=43443
ACTON	93C	PL B307 247	+Alexander, Allison, Allport, Anderson+	(OPAL Collab.)	REFID=43352
ACTON	93L	ZPHY C60 217	+Akers, Alexander, Allison, Anderson+	(OPAL Collab.)	REFID=43595
ADRIANI	93J	PL B317 467	+Aguilar-Benitez, Ahlen, Alcaraz+	(L3 Collab.)	REFID=43583
ADRIANI	93K	PL B317 474	+Aguilar-Benitez, Ahlen, Alcarez+	(L3 Collab.)	REFID=43578
ADRIANI	93L	PL B317 637	+Aguilar-Benitez, Ahlen, Alcaraz+	(L3 Collab.)	REFID=43593
AKERS	93B	ZPHY C60 199	+Alexander, Allison, Anderson, Arcelli+	(OPAL Collab.)	REFID=43594
BUSKULIC	93B	PL B298 479	+Decamp, Goy, Lees, Minard+	(ALEPH Collab.)	REFID=43287
BUSKULIC	93O	PL B314 459	+De Bonis, Decamp, Ghez, Goy+	(ALEPH Collab.)	REFID=43533
ABREU	92	ZPHY C53 567	+Adam, Adami, Adye+	(DELPHI Collab.)	REFID=41870
ACTON	92	PL B274 513	+Alexander, Allison, Allport, Anderson+	(OPAL Collab.)	REFID=41927
ADRIANI	92	PL B288 412	+Aguilar-Benitez, Ahlen, Akbari+	(L3 Collab.)	REFID=42150
BUSKULIC	92F	PL B295 174	+Decamp, Goy, Lees, Minard+	(ALEPH Collab.)	REFID=43136
BUSKULIC	92G	PL B295 396	+Decamp, Goy, Lees, Minard+	(ALEPH Collab.)	REFID=43142
ADEVA	91C	PL B261 177	+Adriani, Aguilar-Benitez, Akbari+	(L3 Collab.)	REFID=41533
ADEVA	91H	PL B270 111	+Adrani, Aguilar-Benitez, Akbari, Alcaraz+	(L3 Collab.)	REFID=41873
ALBAJAR	91C	PL B262 163	+Albrow, Allkofer, Ankoviak, Apsimon+	(UA1 Collab.)	REFID=41551
ALEXANDER	91G	PL B266 485	+Allison, Allport+	(OPAL Collab.)	REFID=41772
DECAMP	91C	PL B257 492	+Deschizeaux, Goy, Lees, Minard+	(ALEPH Collab.)	REFID=41527
BEHREND	90D	ZPHY C47 333	+Criegee, Field, Franke, Jung+	(CELLO Collab.)	REFID=41735
HAGEMANN	90	ZPHY C48 401	+Ramcke, Allison, Ambrus, Barlow+	(JADE Collab.)	REFID=41436
LYONS	90	PR D41 982	+Martin, Saxon	(OXF, BRIS, RAL)	REFID=41240
BRAUNSCH...	89B	ZPHY C44 1	Braunschweig, Gerhards, Kirschfink+	(TASSO Collab.)	REFID=40859
ONG	89	PRL 62 1236	+Jaros, Abrams, Amidei, Baden+	(Mark II Collab.)	REFID=40782
KLEM	88	PR D37 41	+Atwood, Barish+	(DELCO Collab.)	REFID=40399
ONG	88	PRL 60 2587	+Weir, Abrams, Amidei+	(Mark II Collab.)	REFID=40607
ASH	87	PRL 58 640	+Band, Bloom, Bosman+	(MAC Collab.)	REFID=40378
BARTEL	87	ZPHY C33 339	+Becker, Felst, Haidt+	(JADE Collab.)	REFID=40359
BROM	87	PL B195 301	+Abachi, Akerlof, Baringer+	(HRS Collab.)	REFID=40385
PAL	86	PR D33 2708	+Atwood, Barish, Bonneaud+	(DELCO Collab.)	REFID=11479
AIHARA	85	ZPHY C27 39	+Alston-Garnjost, Badtke, Bakken+	(TPC Collab.)	REFID=11469
BARTEL	85J	PL 163B 277	+Becker, Cords, Felst+	(JADE Collab.)	REFID=11473
ALTHOFF	84G	ZPHY C22 219	+Braunschweig, Kirschfink+	(TASSO Collab.)	REFID=11464
ALTHOFF	84J	PL 146B 443	+Branschweig, Kirschfink+	(TASSO Collab.)	REFID=11599
KOOP	84	PRL 52 970	+Sakuda, Atwood, Baillon+	(DELCO Collab.)	REFID=11468
ADEVA	83	PRL 50 799	+Barber, Becker, Berdugo+	(Mark-J Collab.)	REFID=11585
ADEVA	83B	PRL 51 443	+Barber, Becker, Berdugo+	(Mark-J Collab.)	REFID=10610
BARTEL	83B	PL 132B 241	+Becker, Bowdery, Cords+	(JADE Collab.)	REFID=11588
FERNANDEZ	83D	PRL 50 2054	+Ford, Read, Smith+	(MAC Collab.)	REFID=11590
MATTEUZZI	83	PL 129B 141	+Abrams, Amidei, Blocker+	(Mark II Collab.)	REFID=11595
NELSON	83	PRL 50 1542	+Blondel, Trilling, Abrams+	(Mark II Collab.)	REFID=11596