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

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

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.

"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.

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
$1.549\pm0.009\pm0.015$		[2] ACCIARRI	98	L3	$e^+e^- \rightarrow Z$
$1.611\pm0.010\pm0.027$		[3] ACKERSTAFF	97F	OPAL	$e^+e^- \rightarrow Z$
$1.582\pm0.011\pm0.027$		[3] ABREU	96E	DLPH	$e^+e^- \rightarrow Z$
$1.533\pm0.013\pm0.022$	19.8k	[4] BUSKULIC	96F	ALEP	$e^+e^- \rightarrow Z$
$1.564\pm0.030\pm0.036$		[5] ABE,K	95B	SLD	$e^+e^- \rightarrow Z$
$1.542\pm0.021\pm0.045$		[6] ABREU	94L	DLPH	$e^+e^- \rightarrow Z$
$1.523\pm0.034\pm0.038$	5372	[7] ACTON	93L	OPAL	$e^+e^- \rightarrow Z$
$1.511\pm0.022\pm0.078$		[8] BUSKULIC	93O	ALEP	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.575\pm0.010\pm0.026$		[9] ABREU	96E	DLPH	$e^+e^- \rightarrow Z$
$1.50\ ^{+0.24}_{-0.21}\pm0.03$		[10] ABREU	94P	DLPH	$e^+e^- \rightarrow Z$
$1.46\pm0.06\pm0.06$	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
$1.49\pm0.11\pm0.12$	253	[13] ABREU	93G	DLPH	Sup. by ABREU 94L
$1.51\ ^{+0.16}_{-0.14}\pm0.11$	130	[14] ACTON	93C	OPAL	$e^+e^- \rightarrow Z$
$1.535\pm0.035\pm0.028$	7357	[7] ADRIANI	93K	L3	Repl. by ACCIARRI 98
1.28 ± 0.10		[15] ABREU	92	DLPH	Sup. by ABREU 94L
$1.37\pm0.07\pm0.06$	1354	[16] ACTON	92	OPAL	Sup. by ACTON 93L
$1.49\pm0.03\pm0.06$		[17] BUSKULIC	92F	ALEP	Sup. by BUSKULIC 96F
$1.35\ ^{+0.19}_{-0.17}\pm0.05$		[18] BUSKULIC	92G	ALEP	$e^+e^- \rightarrow Z$
$1.32\pm0.08\pm0.09$	1386	[19] ADEVA	91H	L3	Sup. by ADRIANI 93K
$1.32\ ^{+0.31}_{-0.25}\pm0.15$	37	[20] ALEXANDER	91G	OPAL	$e^+e^- \rightarrow Z$

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

[1] Measured using inclusive $J/\psi(1S) \rightarrow \mu^+\mu^-$ vertex.

[2] ACCIARRI 98 uses inclusively reconstructed secondary vertex and lepton impact parameter.

[3] ACKERSTAFF 97F uses inclusively reconstructed secondary vertices.

[4] BUSKULIC 96F analyzed using 3D impact parameter.

[5] ABE,K 95B uses an inclusive topological technique.

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 Their result from inclusively reconstructed secondary vertices is superseded by ABREU 96E.

[7] ACTON 93L and ADRIANI 93K analyzed using lepton (e and μ) impact parameter at Z.

[8] BUSKULIC 93O analyzed using dipole method.

[9] Combines ABREU 96E secondary vertex result with ABREU 94L impact parameter result.

[10] From proper time distribution of $b \rightarrow J/\psi(1S)$ anything.

[11] ABE 93J analyzed using $J/\psi(1S) \rightarrow \mu\mu$ vertices.

[12] ABREU 93D data analyzed using $D\,/\,D^*\,\ell$anything event vertices.

[13] ABREU 93G data analyzed using charged and neutral vertices.

[14] ACTON 93C analysed using $D\,/\,D^*\,\ell$anything event vertices.

[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.

[16] ACTON 92 is combined result of muon and electron impact parameter analyses.

[17] BUSKULIC 92F uses the lepton impact parameter distribution for data from the 1991 run.

[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.

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

[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 $J/\psi(1S)$.

[21] Using $Z \rightarrow e$X or μX, DECAMP 91C determines the average lifetime for an admixture of B hadrons from the signed impact parameter distribution of the lepton.

[22] HAGEMANN 90 uses electrons and muons in an impact parameter analysis.

[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.

[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.

[25] Statistical and systematic errors were combined by BROM 87.

CHARGED b-HADRON ADMIXTURE MEAN LIFE

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.

NEUTRAL b-HADRON ADMIXTURE MEAN LIFE

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.

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

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{1.09^{+0.11}_{-0.10}\pm0.08}$	[28] ADAM	95	DLPH	$e^+e^- \rightarrow Z$

[28] ADAM 95 data analyzed using vertex-charge technique to tag b-hadron charge.

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

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

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.

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

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. In the following, we assume that the production fractions are the same at the LEP and at the Tevatron.

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.

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)	Scale factor/ Confidence level

PRODUCTION FRACTIONS

The production fractions for weakly decaying b-hadrons at high energy 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

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

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

Γ_1	B^+		(38.9 ± 1.3) %	
Γ_2	B^0		(38.9 ± 1.3) %	
Γ_3	B^0_s		(10.7 ± 1.4) %	
Γ_4	b-baryon		(11.6 ± 2.0) %	
Γ_5	B_c		—	

DECAY MODES

Semileptonic and leptonic modes

Γ_6	ν anything		(23.1 ± 1.5) %	
Γ_7	$\ell^+ \nu_\ell$ anything	[a]	(10.73 ± 0.18) %	S=1.1
Γ_8	$e^+ \nu_e$ anything		(10.86 ± 0.35) %	
Γ_9	$\mu^+ \nu_\mu$ anything		$(10.95^{+0.29}_{-0.25})$ %	
Γ_{10}	$D^- \ell^+ \nu_\ell$ anything	[a]	(2.02 ± 0.29) %	
Γ_{11}	$\overline{D}^0 \ell^+ \nu_\ell$ anything	[a]	(6.6 ± 0.6) %	
Γ_{12}	$D^{*-} \ell^+ \nu_\ell$ anything	[a]	(2.76 ± 0.29) %	
Γ_{13}	$\overline{D}^0_j \ell^+ \nu_\ell$ anything	[a,b]	seen	
Γ_{14}	$D^-_j \ell^+ \nu_\ell$ anything	[a,b]	seen	
Γ_{15}	$\overline{D}^*_2(2460)^0 \ell^+ \nu_\ell$ anything		seen	
Γ_{16}	$D^*_2(2460)^- \ell^+ \nu_\ell$ anything		seen	
Γ_{17}	charmless $\ell \overline{\nu}_\ell$	[a]	$(1.7 \pm 0.6) \times 10^{-3}$	
Γ_{18}	$\tau^+ \nu_\tau$ anything		(2.6 ± 0.4) %	
Γ_{19}	$\overline{c} \to \ell^- \overline{\nu}_\ell$ anything	[a]	(8.3 ± 0.4) %	

Charmed meson and baryon modes

Γ_{20}	$\overline{D}^0$ anything		(60.5 ± 3.2) %		
Γ_{21}	$D^0 D_s^{\pm}$ anything	[c]	($9.1^{+3.9}_{-2.8}$) %		
Γ_{22}	$D^{\mp} D_s^{\pm}$ anything	[c]	($4.0^{+2.3}_{-1.8}$) %		
Γ_{23}	$\overline{D}^0 D^0$ anything	[c]	($5.1^{+2.0}_{-1.8}$) %		
Γ_{24}	$D^0 D^{\pm}$ anything	[c]	($2.7^{+1.8}_{-1.6}$) %		
Γ_{25}	$D^{\pm} D^{\mp}$ anything	[c]	< 9	$\times 10^{-3}$	CL=90%
Γ_{26}	D^- anything		(23.7 ± 2.3) %		
Γ_{27}	$D^*(2010)^+$ anything		(17.3 ± 2.0) %		
Γ_{28}	$D_1(2420)^0$ anything		(5.0 ± 1.5) %		
Γ_{29}	$D^*(2010)^{\mp} D_s^{\pm}$ anything	[c]	($3.3^{+1.6}_{-1.3}$) %		
Γ_{30}	$D^0 D^*(2010)^{\pm}$ anything	[c]	($3.0^{+1.1}_{-0.9}$) %		
Γ_{31}	$D^*(2010)^{\pm} D^{\mp}$ anything	[c]	($2.5^{+1.2}_{-1.0}$) %		
Γ_{32}	$D^*(2010)^{\pm} D^*(2010)^{\mp}$ anything	[c]	(1.2 ± 0.4) %		
Γ_{33}	$\overline{D}_2^*(2460)^0$ anything		(4.7 ± 2.7) %		
Γ_{34}	$\overline{D}_s$ anything		(18 ± 5) %		
Γ_{35}	Λ_c anything		(9.7 ± 2.9) %		
Γ_{36}	$\overline{c}\,/\,c$ anything	[d]	(117 ± 4) %		

Charmonium modes

Γ_{37}	$J/\psi(1S)$ anything		(1.16 ± 0.10) %		
Γ_{38}	$\psi(2S)$ anything		(4.8 ± 2.4)	$\times 10^{-3}$	
Γ_{39}	$\chi_{c1}(1P)$ anything		(1.8 ± 0.5) %		

K or K^* modes

Γ_{40}	$\overline{s}\gamma$		(3.1 ± 1.1)	$\times 10^{-4}$	
Γ_{41}	$K^{\pm}$ anything		(74 ± 6) %		
Γ_{42}	K^0_S anything		(29.0 ± 2.9) %		

Pion modes

Γ_{43}	$\pi^{\pm}$ anything		(397 ±21) %		
Γ_{44}	π^0 anything	[d]	(278 ±60) %		

Baryon modes

Γ_{45}	$p\,/\,\overline{p}$ anything		(13.1 ± 1.1) %		

Other modes

Γ_{46}	charged anything	[d]	(497 ± 7) %		
Γ_{47}	hadron$^+$ hadron$^-$		($1.7^{+1.0}_{-0.7}$)	$\times 10^{-5}$	
Γ_{48}	charmless		(7 ±21)	$\times 10^{-3}$	

Baryon modes

Γ_{49}	$\Lambda/\overline{\Lambda}$anything		(5.9 ± 0.6) %	
Γ_{50}	b-baryon anything		(10.2 ± 2.8) %	

$\Delta B = 1$ weak neutral current ($B1$) modes

Γ_{51}	e^+e^- anything				
Γ_{52}	$\mu^+\mu^-$ anything	$B1$	< 3.2	$\times 10^{-4}$	CL=90%
Γ_{53}	$\nu\overline{\nu}$anything				

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

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

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

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

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

$\Gamma(B^0_s)/[\Gamma(B^+)+\Gamma(B^0)]$ — $\Gamma_3/(\Gamma_1+\Gamma_2)$

VALUE	DOCUMENT ID		TECN	COMMENT
0.21 ±0.04 OUR AVERAGE				
0.213±0.068	[30] AFFOLDER	00E	CDF	$p\overline{p}$ at 1.8 TeV
$0.21 \pm 0.036^{+0.038}_{-0.030}$	[31] ABE	99P	CDF	$\overline{p}p$ at 1.8 TeV

[30] AFFOLDER 00E uses several electron-charm final states in $b \to c e^- X$.
[31] ABE 99P uses the numbers of $K^*(892)^0$, $K^*(892)^+$, and $\phi(1020)$ events produced in association with the double semileptonic decays $b \to c\mu^- X$ with $c \to s\mu^+ X$.

$\Gamma(b\text{-baryon})/[\Gamma(B^+)+\Gamma(B^0)]$ — $\Gamma_4/(\Gamma_1+\Gamma_2)$

VALUE	DOCUMENT ID		TECN	COMMENT
0.118±0.042	[32] AFFOLDER	00E	CDF	$p\overline{p}$ at 1.8 TeV

[32] AFFOLDER 00E uses several electron-charm final states in $b \to c e^- X$.

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.2308±0.0077±0.0124	[33,34] ACCIARRI	96C	L3	$e^+e^- \to Z$

[33] ACCIARRI 96C assumes relative b semileptonic decay rates e:μ:τ of 1:1:0.25. Based on missing-energy spectrum.
[34] Assumes Standard Model value for R_B.

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.1073±0.0018 OUR AVERAGE	Error includes scale factor of 1.1.		
$0.1083 \pm 0.0010 {}^{+0.0028}_{-0.0024}$	[35] ABBIENDI 00E	OPAL	$e^+ e^- \rightarrow Z$
$0.1016 \pm 0.0013 \pm 0.0030$	[36] ACCIARRI 00	L3	$e^+ e^- \rightarrow Z$
$0.1085 \pm 0.0012 \pm 0.0047$	[37,38] ACCIARRI 96C	L3	$e^+ e^- \rightarrow Z$
$0.1106 \pm 0.0039 \pm 0.0022$	[39] ABREU 95D	DLPH	$e^+ e^- \rightarrow Z$
$0.114 \pm 0.003 \pm 0.004$	[40] BUSKULIC 94G	ALEP	$e^+ e^- \rightarrow Z$
$0.100 \pm 0.007 \pm 0.007$	[41] ABREU 93C	DLPH	$e^+ e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.105 \pm 0.006 \pm 0.005$	[42] AKERS 93B	OPAL	Repl. by ABBIENDI 00E

[35] ABBIENDI 00E result is determined by comparing the distribution of several kinematic variables of leptonic events in a lifetime tagged $Z \rightarrow b\overline{b}$ sample using artificial neural network techniques. The first error is statistic; the second error is the total systematic error.

[36] ACCIARRI 00 result obtained from a combined fit of $R_b = \Gamma(Z \rightarrow b\overline{b})/\Gamma(Z \rightarrow \text{hadrons})$ and $B(b \rightarrow \ell\nu X)$, using double-tagging method.

[37] ACCIARRI 96C result obtained by a fit to the single lepton spectrum.

[38] Assumes Standard Model value for R_B.

[39] ABREU 95D give systematic errors ± 0.0019 (model) and 0.0012 (R_c). We combine these in quadrature.

[40] 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.

[41] ABREU 93C event count includes ee events. Combining ee, $\mu\mu$, and $e\mu$ events, they obtain $0.100 \pm 0.007 \pm 0.007$.

[42] AKERS 93B analysis performed using single and dilepton events.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1086±0.0035 OUR AVERAGE				
$0.1078 \pm 0.0008 {}^{+0.0050}_{-0.0046}$		[43] ABBIENDI 00E	OPAL	$e^+ e^- \rightarrow Z$
$0.1089 \pm 0.0020 \pm 0.0051$		[44,45] ACCIARRI 96C	L3	$e^+ e^- \rightarrow Z$
$0.107 \pm 0.015 \pm 0.007$	260	[46] ABREU 93C	DLPH	$e^+ e^- \rightarrow Z$
$0.138 \pm 0.032 \pm 0.008$		[47] ADEVA 91C	L3	$e^+ e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.086 \pm 0.027 \pm 0.008$		[48] ABE 93E	VNS	$E^{ee}_{cm} = 58$ GeV
$0.109 {}^{+0.014}_{-0.013} \pm 0.0055$	2719	[49] AKERS 93B	OPAL	Repl. by ABBIENDI 00E
$0.111 \pm 0.028 \pm 0.026$		BEHREND 90D	CELL	$E^{ee}_{cm} = 43$ GeV
$0.150 \pm 0.011 \pm 0.022$		BEHREND 90D	CELL	$E^{ee}_{cm} = 35$ GeV
$0.112 \pm 0.009 \pm 0.011$		ONG 88	MRK2	$E^{ee}_{cm} = 29$ GeV
$0.149 {}^{+0.022}_{-0.019}$		PAL 86	DLCO	$E^{ee}_{cm} = 29$ GeV
$0.110 \pm 0.018 \pm 0.010$		AIHARA 85	TPC	$E^{ee}_{cm} = 29$ GeV
$0.111 \pm 0.034 \pm 0.040$		ALTHOFF 84J	TASS	$E^{ee}_{cm} = 34.6$ GeV
0.146 ± 0.028		KOOP 84	DLCO	Repl. by PAL 86
$0.116 \pm 0.021 \pm 0.017$		NELSON 83	MRK2	$E^{ee}_{cm} = 29$ GeV

[43] ABBIENDI 00E result is determined by comparing the distribution of several kinematic variables of leptonic events in a lifetime tagged $Z \to b\overline{b}$ sample using artificial neural network techniques. The first error is statistic; the second error is the total systematic error.

[44] ACCIARRI 96C result obtained by a fit to the single lepton spectrum.

[45] Assumes Standard Model value for R_B.

[46] ABREU 93C event count includes ee events. Combining ee, $\mu\mu$, and $e\mu$ events, they obtain $0.100 \pm 0.007 \pm 0.007$.

[47] 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 $0.113 \pm 0.010 \pm 0.006$. 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 $0.112 \pm 0.004 \pm 0.008$. They obtain $0.119 \pm 0.003 \pm 0.006$ when e and μ results are combined. Used to measure the $b\overline{b}$ width itself, this electron result gives $370 \pm 12 \pm 24$ MeV and combined with the muon result gives $385 \pm 7 \pm 22$ MeV.

[48] ABE 93E experiment also measures forward-backward asymmetries and fragmentation functions for b and c.

[49] AKERS 93B analysis performed using single and dilepton events.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.1095^{+0.0029}_{-0.0025}$ OUR AVERAGE				
$0.1096 \pm 0.0008 ^{+0.0034}_{-0.0027}$		[50] ABBIENDI 00E	OPAL	$e^+e^- \to Z$
$0.1082 \pm 0.0015 \pm 0.0059$		[51,52] ACCIARRI 96C	L3	$e^+e^- \to Z$
$0.110 \pm 0.012 \pm 0.007$	656	[53] ABREU 93C	DLPH	$e^+e^- \to Z$
$0.113 \pm 0.012 \pm 0.006$		[54] ADEVA 91C	L3	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.122 \pm 0.006 \pm 0.007$		[52] UENO 96	AMY	e^+e^- at 57.9 GeV
$0.101 ^{+0.010}_{-0.009} \pm 0.0055$	4248	[55] AKERS 93B	OPAL	Repl. by ABBIENDI 00E
$0.104 \pm 0.023 \pm 0.016$		BEHREND 90D	CELL	E^{ee}_{cm}= 43 GeV
$0.148 \pm 0.010 \pm 0.016$		BEHREND 90D	CELL	E^{ee}_{cm}= 35 GeV
$0.118 \pm 0.012 \pm 0.010$		ONG 88	MRK2	E^{ee}_{cm}= 29 GeV
$0.117 \pm 0.016 \pm 0.015$		BARTEL 87	JADE	E^{ee}_{cm}= 34.6 GeV
$0.114 \pm 0.018 \pm 0.025$		BARTEL 85J	JADE	Repl. by BARTEL 87
$0.117 \pm 0.028 \pm 0.010$		ALTHOFF 84G	TASS	E^{ee}_{cm}= 34.5 GeV
$0.105 \pm 0.015 \pm 0.013$		ADEVA 83B	MRKJ	E^{ee}_{cm}= 33–38.5 GeV
$0.155 ^{+0.054}_{-0.029}$		FERNANDEZ 83D	MAC	E^{ee}_{cm}= 29 GeV

[50] ABBIENDI 00E result is determined by comparing the distribution of several kinematic variables of leptonic events in a lifetime tagged $Z \to b\overline{b}$ sample using artificial neural network techniques. The first error is statistic; the second error is the total systematic error.

[51] ACCIARRI 96C result obtained by a fit to the single lepton spectrum.

[52] Assumes Standard Model value for R_B.

[53] ABREU 93C event count includes $\mu\mu$ events. Combining ee, $\mu\mu$, and $e\mu$ events, they obtain $0.100 \pm 0.007 \pm 0.007$.

[54] 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 $0.113 \pm 0.010 \pm 0.006$. 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 $0.123 \pm 0.003 \pm 0.006$.

They obtain $0.119 \pm 0.003 \pm 0.006$ 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.

[55] AKERS 93B analysis performed using single and dilepton events.

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.0202±0.0026±0.0013	[56] AKERS	95Q	OPAL	$e^+ e^- \rightarrow Z$

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.066±0.006±0.001	[57] AKERS	95Q	OPAL	$e^+ e^- \rightarrow Z$

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.0276±0.0027±0.0011	[58] AKERS	95Q	OPAL	$e^+ e^- \rightarrow Z$

[58] AKERS 95Q reports $[B(\overline{b} \rightarrow D^* \ell^+ \nu_\ell X) \times B(D^{*+} \rightarrow D^0 \pi^+) \times B(D^0 \rightarrow K^- \pi^+)] = ((7.53 \pm 0.47 \pm 0.56) \times 10^{-4})$ and uses $B(D^{*+} \rightarrow D^0 \pi^+) = 0.681 \pm 0.013$ and $B(D^0 \rightarrow K^- \pi^+) = 0.0401 \pm 0.0014$ 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.

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[59] AKERS	95Q	OPAL	$e^+ e^- \rightarrow Z$

[59] AKERS 95Q quotes the product branching ratio $B(\overline{b} \rightarrow \overline{D}_j^0 \ell^+ \nu_\ell X)\, B(\overline{D}_j^0 \rightarrow D^{*+} \pi^-) = ((6.1 \pm 1.3 \pm 1.3) \times 10^{-3})$.

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[60] AKERS	95Q	OPAL	$e^+ e^- \rightarrow Z$

[60] AKERS 95Q quotes the product branching ratio $B(\overline{b} \rightarrow D_j^- \ell^+ \nu_\ell \text{anything})\, B(D_j^- \rightarrow D^0 \pi^-) = ((7.0 \pm 1.9^{+1.2}_{-1.3}) \times 10^{-3})$.

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

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[61] AKERS	95Q	OPAL	$e^+e^- \to Z$

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[62] AKERS	95Q	OPAL	$e^+e^- \to Z$

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

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

"OUR EVALUATION" is an average of the data listed below performed by the LEP Heavy Flavour Steering Group. The averaging procedure takes into account correlations between the measurements.

VALUE	DOCUMENT ID		TECN	COMMENT
0.00167±0.00055 OUR EVALUATION				
0.0017 ±0.0005 OUR AVERAGE				
0.00157±0.00035±0.00055	[63] ABREU	00D	DLPH	$e^+e^- \to Z$
0.00173±0.00055±0.00055	[64] BARATE	99G	ALEP	$e^+e^- \to Z$
0.0033 ±0.0010 ±0.0017	[65] ACCIARRI	98K	L3	$e^+e^- \to Z$

[63] ABREU 00D result obtained from a fit to the numbers of decays in $b \to u$ enriched and depleted samples and their lepton spectra, and assuming $|V_{cb}| = 0.0384 \pm 0.0033$ and $\tau_b = 1.564 \pm 0.014$ ps.
[64] Uses lifetime tagged $b\overline{b}$ sample.
[65] ACCIARRI 98K assumes $R_b = 0.2174 \pm 0.0009$ at Z decay.

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.6 ±0.4 OUR AVERAGE					
1.7 ±0.5 ±1.1		[66,67] ACCIARRI	96C	L3	$e^+e^- \to Z$
2.75±0.30±0.37	405	[68] BUSKULIC	95	ALEP	$e^+e^- \to Z$
2.4 ±0.7 ±0.8	1032	[69] 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

[66] ACCIARRI 96C result obtained from missing energy spectrum.
[67] Assumes Standard Model value for R_B.
[68] BUSKULIC 95 uses missing-energy technique.
[69] This is a direct result using tagged $b\overline{b}$ events at the Z, but species are not separated.

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.083 ±0.004 OUR AVERAGE			
$0.0840 \pm 0.0016 {}^{+0.0039}_{-0.0036}$	[70] ABBIENDI 00E	OPAL	$e^+e^- \to Z$
$0.0770 \pm 0.0097 \pm 0.0046$	[71] ABREU 95D	DLPH	$e^+e^- \to Z$
$0.082 \pm 0.003 \pm 0.012$	[72] BUSKULIC 94G	ALEP	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.077 \pm 0.004 \pm 0.007$	[73] AKERS 93B	OPAL	Repl. by ABBIENDI 00E

[70] ABBIENDI 00E result is determined by comparing the distribution of several kinematic variables of leptonic events in a lifetime tagged $Z \to b\overline{b}$ sample using artificial neural network techniques. The first error is statistic; the second error is the total systematic error.

[71] 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.

[72] BUSKULIC 94G uses e and μ events. This value is from the same global fit as their $\Gamma(\overline{b} \to \ell^+ \nu_\ell \text{anything})/\Gamma_{\text{total}}$ data.

[73] AKERS 93B analysis performed using single and dilepton events.

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.605±0.029±0.014	[74] BUSKULIC 96Y	ALEP	$e^+e^- \to Z$

[74] BUSKULIC 96Y reports $0.605 \pm 0.024 \pm 0.016$ 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.

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

VALUE	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.091^{+0.020}_{-0.018}{}^{+0.034}_{-0.022}}$	[75] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.040^{+0.017}_{-0.014}{}^{+0.016}_{-0.011}}$	[76] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.131^{+0.026}_{-0.022}{}^{+0.048}_{-0.031}}$	[77] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.051^{+0.016}_{-0.014}{}^{+0.012}_{-0.011}}$	[78] BARATE 98Q	ALEP	$e^+e^- \to Z$

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.027^{+0.015}_{-0.013}{}^{+0.010}_{-0.009}}$	[79] BARATE	98Q	ALEP	$e^+e^- \to Z$

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.078^{+0.020}_{-0.018}{}^{+0.018}_{-0.016}}$	[80] BARATE	98Q	ALEP	$e^+e^- \to Z$

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

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.237±0.017±0.015	[81] BUSKULIC	96Y	ALEP	$e^+e^- \to Z$

[81] 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.

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.173±0.016±0.012	[82] ACKERSTAFF	98E	OPAL	$e^+e^- \to Z$

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.050±0.014±0.006	[83] ACKERSTAFF	97W	OPAL	$e^+e^- \to Z$

[83] 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.

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

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.033^{+0.010}_{-0.009}{}^{+0.012}_{-0.009}}$	[84] BARATE	98Q	ALEP	$e^+e^- \to Z$

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.030^{+0.009}_{-0.008}{}^{+0.007}_{-0.005}}$	[85] BARATE	98Q	ALEP	$e^+e^- \to Z$

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

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

VALUE	*DOCUMENT ID*	*TECN*	*COMMENT*
$\mathbf{0.025^{+0.010}_{-0.009}{}^{+0.006}_{-0.005}}$	[86] BARATE 98Q	ALEP	$e^+e^- \rightarrow Z$

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

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

VALUE	*DOCUMENT ID*	*TECN*	*COMMENT*
$\mathbf{0.012^{+0.004}_{-0.003}\pm 0.002}$	[87] BARATE 98Q	ALEP	$e^+e^- \rightarrow Z$

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

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

VALUE	*DOCUMENT ID*	*TECN*	*COMMENT*
0.047±0.024±0.013	[88] ACKERSTAFF 97W	OPAL	$e^+e^- \rightarrow Z$

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

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

VALUE	*DOCUMENT ID*	*TECN*	*COMMENT*
0.18±0.02±0.04	[89] BUSKULIC 96Y	ALEP	$e^+e^- \rightarrow Z$

[89] BUSKULIC 96Y reports 0.183 ± 0.019 ± 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.

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

VALUE	*DOCUMENT ID*	*TECN*	*COMMENT*
0.097±0.013±0.025	[90] BUSKULIC 96Y	ALEP	$e^+e^- \rightarrow Z$

[90] BUSKULIC 96Y reports 0.110 ± 0.014 ± 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.

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

VALUE	*DOCUMENT ID*	*TECN*	*COMMENT*
1.17 ±0.04 OUR AVERAGE			
1.147±0.041	[91] ABREU 98D	DLPH	$e^+e^- \rightarrow Z$
1.230±0.036±0.065	[92] BUSKULIC 96Y	ALEP	$e^+e^- \rightarrow Z$

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

[92] 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.

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

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.16±0.10 OUR AVERAGE					
1.12±0.12±0.10			[93] ABREU 94P	DLPH	$e^+e^- \rightarrow Z$
1.16±0.16±0.14		121	[94] 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			[95] ADRIANI 92	L3	$e^+e^- \rightarrow Z$
<4.9	90		MATTEUZZI 83	MRK2	E^{ee}_{cm}= 29 GeV

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

[94] 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.

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.0048±0.0022±0.0010	[96] ABREU 94P	DLPH	$e^+e^- \rightarrow Z$

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.018±0.005 OUR AVERAGE				
$0.014\pm0.006^{+0.004}_{-0.002}$		[97] ABREU 94P	DLPH	$e^+e^- \rightarrow Z$
0.024±0.009±0.002	19	[98] ADRIANI 93J	L3	$e^+e^- \rightarrow Z$

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

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.92±0.82	121	[99] ADRIANI 93J	L3	$e^+e^- \rightarrow Z$

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

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
3.11±0.80±0.72		[100] BARATE	98I	ALEP	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<5.4	90	[101] ADAM	96D	DLPH	$e^+e^- \to Z$
<12	90	[102] ADRIANI	93L	L3	$e^+e^- \to Z$

[100] BARATE 98I uses liftime tagged $Z \to b\overline{b}$ sample.
[101] ADAM 96D assumes $f_{B^0} = f_{B^-} = 0.39$ and $f_{B_s} = 0.12$.
[102] ADRIANI 93L result is for $\overline{b} \to \overline{s}\gamma$ is performed inclusively.

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

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

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

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

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

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
2.78±0.15±0.60	[103] ADAM	96	DLPH	$e^+e^- \to Z$

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

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

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
4.97±0.03±0.06	[104] 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

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

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

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
$\mathbf{1.7^{+1.0}_{-0.7}\pm0.2}$	[105,106] BUSKULIC	96V	ALEP	$e^+e^- \to Z$

[105] BUSKULIC 96V assumes PDG 96 production fractions for B^0, B^+, B_s, b baryons.
[106] Average branching fraction of weakly decaying B hadrons into two long-lived charged hadrons, weighted by their production cross section and lifetimes.

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.007±0.021	[107] ABREU	98D	DLPH	$e^+e^- \to Z$

[107] 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.

$\Gamma(\Lambda/\overline{\Lambda}\text{anything})/\Gamma_{\text{total}}$ — 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	$e^+e^- \to Z$

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.102±0.007±0.027	[108] BARATE	98V	ALEP	$e^+e^- \to Z$

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

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

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.2 × 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 × 10^{-5}	90	[109] 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

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

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

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

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<3.9 × 10^{-4}	[110] GROSSMAN	96	RVUE	$e^+e^- \to Z$

[110] 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.

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

ABBIENDI	00E	EPJ C13 225	G. Abbiendi et al.	(OPAL Collab.)
ABREU	00D	PL B478 14	P. Abreu et al.	(DELPHI Collab.)
ACCIARRI	00	EPJ C13 47	M. Acciarri et al.	(L3 Collab.)
AFFOLDER	00E	PRL 84 1663	T. Affolder et al.	(CDF Collab.)
ABBIENDI	99J	EPJ C12 609	G. Abbiendi et al.	(OPAL Collab.)
ABE	99P	PR D60 092005	F. Abe et al.	(CDF Collab.)
BARATE	99G	EPJ C6 555	R. Barate et al.	(ALEPH Collab.)
ABBOTT	98B	PL B423 419	B. Abbott et al.	(D0 Collab.)
ABE	98B	PR D57 5382	F. Abe et al.	(CDF Collab.)
ABREU	98D	PL B426 193	P. Abreu et al.	(DELPHI Collab.)
ABREU	98H	PL B425 399	P. Abreu et al.	(DELPHI Collab.)
ACCIARRI	98	PL B416 220	M. Acciarri et al.	(L3 Collab.)
ACCIARRI	98K	PL B436 174	M. Acciarri et al.	(L3 Collab.)
ACKERSTAFF	98E	EPJ C1 439	K. Ackerstaff et al.	(OPAL Collab.)
BARATE	98I	PL B429 169	R. Barate et al.	(ALEPH Collab.)
BARATE	98Q	EPJ C4 387	R. Barate et al.	(ALEPH Collab.)
BARATE	98V	EPJ C5 205	R. Barate et al.	(ALEPH Collab.)
GLENN	98	PRL 80 2289	S. Glenn et al.	(CLEO Collab.)
ACKERSTAFF	97F	ZPHY C73 397	K. Ackerstaff et al.	(OPAL Collab.)
ACKERSTAFF	97N	ZPHY C74 423	K. Ackerstaff et al.	(OPAL Collab.)
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff et al.	(OPAL Collab.)
ABREU	96E	PL B377 195	P. Abreu et al.	(DELPHI Collab.)
ACCIARRI	96C	ZPHY C71 379	M. Acciarri et al.	(L3 Collab.)
ADAM	96	ZPHY C69 561	W. Adam et al.	(DELPHI Collab.)
ADAM	96D	ZPHY C72 207	W. Adam et al.	(DELPHI Collab.)
BUSKULIC	96F	PL B369 151	D. Buskulic et al.	(ALEPH Collab.)
BUSKULIC	96V	PL B384 471	D. Buskulic et al.	(ALEPH Collab.)
BUSKULIC	96Y	PL B388 648	D. Buskulic et al.	(ALEPH Collab.)
GROSSMAN	96	NP B465 369	Y. Grossman, Z. Ligeti, E. Nardi	(REHO, CIT)
Also	96B	NP B480 753 (erratum)	Y. Grossman, Z. Ligeti, E. Nardi	
PDG	96	PR D54 1	R. M. Barnett et al.	
UENO	96	PL B381 365	K. Ueno et al.	(AMY Collab.)
ABE,K	95B	PRL 75 3624	K. Abe et al.	(SLD Collab.)
ABREU	95C	PL B347 447	P. Abreu et al.	(DELPHI Collab.)
ABREU	95D	ZPHY C66 323	P. Abreu et al.	(DELPHI Collab.)
ADAM	95	ZPHY C68 363	W. Adam et al.	(DELPHI Collab.)
AKERS	95Q	ZPHY C67 57	R. Akers et al.	(OPAL Collab.)
BUSKULIC	95	PL B343 444	D. Buskulic et al.	(ALEPH Collab.)
ABREU	94L	ZPHY C63 3	P. Abreu et al.	(DELPHI Collab.)
ABREU	94P	PL B341 109	P. Abreu et al.	(DELPHI Collab.)
ACCIARRI	94C	PL B332 201	M. Acciarri et al.	(L3 Collab.)
BUSKULIC	94G	ZPHY C62 179	D. Buskulic et al.	(ALEPH Collab.)
ABE	93E	PL B313 288	K. Abe et al.	(VENUS Collab.)
ABE	93J	PRL 71 3421	F. Abe et al.	(CDF Collab.)
ABREU	93C	PL B301 145	P. Abreu et al.	(DELPHI Collab.)
ABREU	93D	ZPHY C57 181	P. Abreu et al.	(DELPHI Collab.)
ABREU	93G	PL B312 253	P. Abreu et al.	(DELPHI Collab.)
ACTON	93C	PL B307 247	P.D. Acton et al.	(OPAL Collab.)
ACTON	93L	ZPHY C60 217	P.D. Acton et al.	(OPAL Collab.)
ADRIANI	93J	PL B317 467	O. Adriani et al.	(L3 Collab.)
ADRIANI	93K	PL B317 474	O. Adriani et al.	(L3 Collab.)
ADRIANI	93L	PL B317 637	O. Adriani et al.	(L3 Collab.)
AKERS	93B	ZPHY C60 199	R. Akers et al.	(OPAL Collab.)
BUSKULIC	93B	PL B298 479	D. Buskulic et al.	(ALEPH Collab.)
BUSKULIC	93O	PL B314 459	D. Buskulic et al.	(ALEPH Collab.)
ABREU	92	ZPHY C53 567	P. Abreu et al.	(DELPHI Collab.)
ACTON	92	PL B274 513	D.P. Acton et al.	(OPAL Collab.)
ADRIANI	92	PL B288 412	O. Adriani et al.	(L3 Collab.)
BUSKULIC	92F	PL B295 174	D. Buskulic et al.	(ALEPH Collab.)
BUSKULIC	92G	PL B295 396	D. Buskulic et al.	(ALEPH Collab.)
ADEVA	91C	PL B261 177	B. Adeva et al.	(L3 Collab.)
ADEVA	91H	PL B270 111	B. Adeva et al.	(L3 Collab.)
ALBAJAR	91C	PL B262 163	C. Albajar et al.	(UA1 Collab.)
ALEXANDER	91G	PL B266 485	G. Alexander et al.	(OPAL Collab.)
DECAMP	91C	PL B257 492	D. Decamp et al.	(ALEPH Collab.)

BEHREND	90D	ZPHY C47 333	H.J. Behrend *et al.*	(CELLO Collab.)
HAGEMANN	90	ZPHY C48 401	J. Hagemann *et al.*	(JADE Collab.)
LYONS	90	PR D41 982	L. Lyons, A.J. Martin, D.H. Saxon	(OXF, BRIS+)
BRAUNSCH...	89B	ZPHY C44 1	R. Braunschweig *et al.*	(TASSO Collab.)
ONG	89	PRL 62 1236	R.A. Ong *et al.*	(Mark II Collab.)
KLEM	88	PR D37 41	D.E. Klem *et al.*	(DELCO Collab.)
ONG	88	PRL 60 2587	R.A. Ong *et al.*	(Mark II Collab.)
ASH	87	PRL 58 640	W.W. Ash *et al.*	(MAC Collab.)
BARTEL	87	ZPHY C33 339	W. Bartel *et al.*	(JADE Collab.)
BROM	87	PL B195 301	J.M. Brom *et al.*	(HRS Collab.)
PAL	86	PR D33 2708	T. Pal *et al.*	(DELCO Collab.)
AIHARA	85	ZPHY C27 39	H. Aihara *et al.*	(TPC Collab.)
BARTEL	85J	PL 163B 277	W. Bartel *et al.*	(JADE Collab.)
ALTHOFF	84G	ZPHY C22 219	M. Althoff *et al.*	(TASSO Collab.)
ALTHOFF	84J	PL 146B 443	M. Althoff *et al.*	(TASSO Collab.)
KOOP	84	PRL 52 970	D.E. Koop *et al.*	(DELCO Collab.)
ADEVA	83	PRL 50 799	B. Adeva *et al.*	(Mark-J Collab.)
ADEVA	83B	PRL 51 443	B. Adeva *et al.*	(Mark-J Collab.)
BARTEL	83B	PL 132B 241	W. Bartel *et al.*	(JADE Collab.)
FERNANDEZ	83D	PRL 50 2054	E. Fernandez *et al.*	(MAC Collab.)
MATTEUZZI	83	PL 129B 141	C. Matteuzzi *et al.*	(Mark II Collab.)
NELSON	83	PRL 50 1542	M.E. Nelson *et al.*	(Mark II Collab.)