



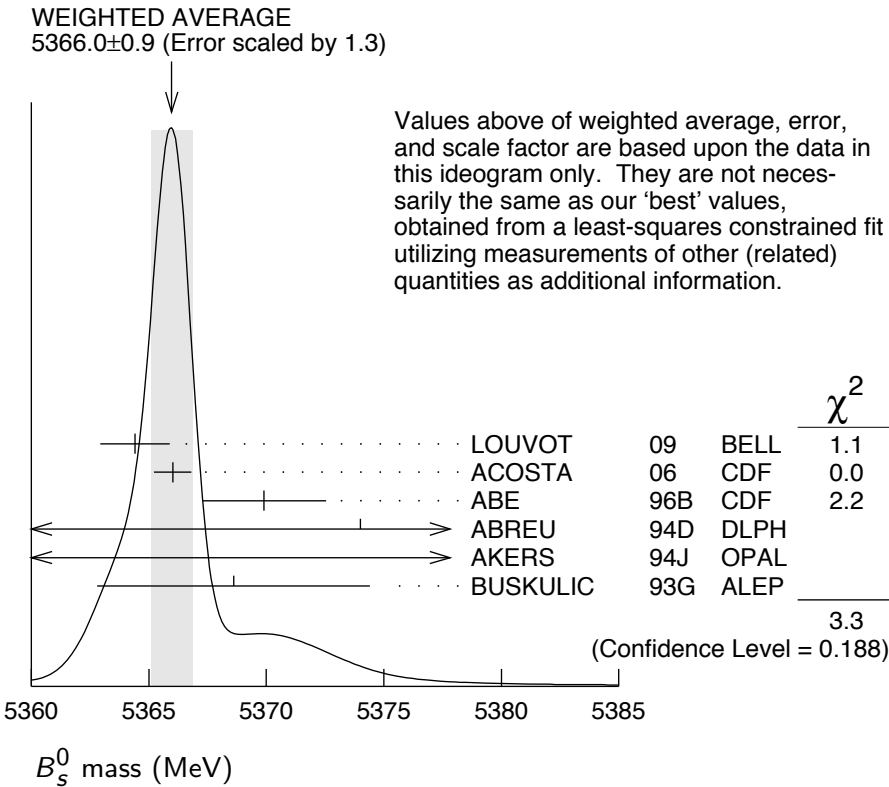
$I(J^P) = 0(0^-)$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

B_s^0 MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
5366.3 ± 0.6 OUR FIT	Error includes scale factor of 1.1.			
5366.0 ± 0.9 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
5364.4 ± 1.3 ± 0.7		LOUVOT	09	BELL $e^+e^- \rightarrow \Upsilon(5S)$
5366.01 ± 0.73 ± 0.33		¹ ACOSTA	06	CDF $p\bar{p}$ at 1.96 TeV
5369.9 ± 2.3 ± 1.3	32	² ABE	96B	CDF $p\bar{p}$ at 1.8 TeV
5374 ± 16 ± 2	3	ABREU	94D	DLPH $e^+e^- \rightarrow Z$
5359 ± 19 ± 7	1	² AKERS	94J	OPAL $e^+e^- \rightarrow Z$
5368.6 ± 5.6 ± 1.5	2	BUSKULIC	93G	ALEP $e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5370 ± 1 ± 3		DRUTSKOY	07A	BELL Repl. by LOUVOT 09
5370 ± 40	6	³ AKERS	94J	OPAL $e^+e^- \rightarrow Z$
5383.3 ± 4.5 ± 5.0	14	ABE	93F	CDF Repl by ABE 96B

¹ Uses exclusively reconstructed final states containing a $J/\psi \rightarrow \mu^+\mu^-$ decays.
² From the decay $B_s \rightarrow J/\psi(1S)\phi$.
³ From the decay $B_s \rightarrow D_s^- \pi^+$.



$$m_{B_s^0} - m_B$$

m_B is the average of our B masses $(m_{B^\pm} + m_{B^0})/2$.

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
87.0 ±0.6 OUR FIT				
86.9 ±0.8 OUR AVERAGE				
86.64 ±0.80 ±0.08		⁴ ACOSTA	06 CDF	$p\bar{p}$ at 1.96 TeV
89.7 ±2.7 ±1.2		ABE	96B CDF	$p\bar{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
80 to 130	68	LEE-FRANZINI90	CSB2	$e^+e^- \rightarrow \Upsilon(5S)$
⁴ The reported result is $m_{B_s^0} - m_{B^0} = 86.38 \pm 0.90 \pm 0.06$ MeV. We convert it to the mass difference with respect to the average of $(m_{B^\pm} + m_{B^0})/2$.				

$$m_{B_s^0 H} - m_{B_s^0 L}$$

See the $B_s^0\text{-}\bar{B}_s^0$ MIXING section near the end of these B_s^0 Listings.

B_s^0 MEAN LIFE

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

The

First "OUR EVALUATION" is an average of $1 / [0.5 (\Gamma_{B_s^0 L} + \Gamma_{B_s^0 H})]$.

The Second "OUR EVALUATION" is the average of $B_s \rightarrow D_s X$ data listed below.

VALUE (10^{-12} s)	EVTs	DOCUMENT ID	TECN	COMMENT
1.472^{+0.024}_{-0.026} OUR EVALUATION	First			
1.425 ±0.041 OUR EVALUATION	Second			
1.398 ±0.044 ^{+0.028} _{-0.025}		⁵ ABAZOV	06V D0	$p\bar{p}$ at 1.96 TeV
1.42 ^{+0.14} _{-0.13} ±0.03		⁶ ABREU	00Y DLPH	$e^+e^- \rightarrow Z$
1.53 ^{+0.16} _{-0.15} ±0.07		⁷ ABREU,P	00G DLPH	$e^+e^- \rightarrow Z$
1.36 ±0.09 ^{+0.06} _{-0.05}		⁸ ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
1.72 ^{+0.20} _{-0.19} ±0.18 _{-0.17}		⁹ ACKERSTAFF	98F OPAL	$e^+e^- \rightarrow Z$
1.50 ^{+0.16} _{-0.15} ±0.04		⁸ ACKERSTAFF	98G OPAL	$e^+e^- \rightarrow Z$
1.47 ±0.14 ±0.08		⁷ BARATE	98C ALEP	$e^+e^- \rightarrow Z$
1.54 ^{+0.14} _{-0.13} ±0.04		⁸ BUSKULIC	96M ALEP	$e^+e^- \rightarrow Z$

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

1.51 ± 0.11		¹⁰ BARATE	98C	ALEP	$e^+e^- \rightarrow Z$
1.56 $\begin{smallmatrix} +0.29 \\ -0.26 \end{smallmatrix}$ $\begin{smallmatrix} +0.08 \\ -0.07 \end{smallmatrix}$		⁸ ABREU	96F	DLPH	Repl. by ABREU 00Y
1.65 $\begin{smallmatrix} +0.34 \\ -0.31 \end{smallmatrix}$ ± 0.12		⁷ ABREU	96F	DLPH	Repl. by ABREU 00Y
1.76 ± 0.20 $\begin{smallmatrix} +0.15 \\ -0.10 \end{smallmatrix}$		¹¹ ABREU	96F	DLPH	Repl. by ABREU 00Y
1.60 ± 0.26 $\begin{smallmatrix} +0.13 \\ -0.15 \end{smallmatrix}$		¹² ABREU	96F	DLPH	Repl. by ABREU,P 00G
1.67 ± 0.14		¹³ ABREU	96F	DLPH	$e^+e^- \rightarrow Z$
1.61 $\begin{smallmatrix} +0.30 \\ -0.29 \end{smallmatrix}$ $\begin{smallmatrix} +0.18 \\ -0.16 \end{smallmatrix}$	90	⁷ BUSKULIC	96E	ALEP	Repl. by BARATE 98C
1.42 $\begin{smallmatrix} +0.27 \\ -0.23 \end{smallmatrix}$ ± 0.11	76	⁸ ABE	95R	CDF	Repl. by ABE 99D
1.74 $\begin{smallmatrix} +1.08 \\ -0.69 \end{smallmatrix}$ ± 0.07	8	¹⁴ ABE	95R	CDF	Sup. by ABE 96N
1.54 $\begin{smallmatrix} +0.25 \\ -0.21 \end{smallmatrix}$ ± 0.06	79	⁸ AKERS	95G	OPAL	Repl. by ACKER-STAFF 98G
1.59 $\begin{smallmatrix} +0.17 \\ -0.15 \end{smallmatrix}$ ± 0.03	134	⁸ BUSKULIC	95O	ALEP	Sup. by BUSKULIC 96M
0.96 ± 0.37	41	¹⁵ ABREU	94E	DLPH	Sup. by ABREU 96F
1.92 $\begin{smallmatrix} +0.45 \\ -0.35 \end{smallmatrix}$ ± 0.04	31	⁸ BUSKULIC	94C	ALEP	Sup. by BUSKULIC 95O
1.13 $\begin{smallmatrix} +0.35 \\ -0.26 \end{smallmatrix}$ ± 0.09	22	⁸ ACTON	93H	OPAL	Sup. by AKERS 95G

⁵ Measured using $D_S \mu^+$ vertices.

⁶ Uses $D_S^- \ell^+$, and $\phi \ell^+$ vertices.

⁷ Measured using D_S hadron vertices.

⁸ Measured using $D_S^- \ell^+$ vertices.

⁹ ACKERSTAFF 98F use fully reconstructed $D_S^- \rightarrow \phi \pi^-$ and $D_S^- \rightarrow K^{*0} K^-$ in the inclusive B_S^0 decay.

¹⁰ Combined results from $D_S^- \ell^+$ and D_S hadron.

¹¹ Measured using $\phi \ell$ vertices.

¹² Measured using inclusive D_S vertices.

¹³ Combined result for the four ABREU 96F methods.

¹⁴ Exclusive reconstruction of $B_S \rightarrow \psi \phi$.

¹⁵ ABREU 94E uses the flight-distance distribution of D_S vertices, ϕ -lepton vertices, and $D_S \mu$ vertices.

B_S^0 MEAN LIFE (Flavor specific)

VALUE (10^{-12} s)	DOCUMENT ID	TECN	COMMENT
1.417\pm0.042 OUR EVALUATION			
1.41 \pm0.04 OUR AVERAGE			
1.398 \pm 0.044 $\begin{smallmatrix} +0.028 \\ -0.025 \end{smallmatrix}$	¹⁶ ABAZOV	06V D0	$p\bar{p}$ at 1.96 TeV
1.42 $\begin{smallmatrix} +0.14 \\ -0.13 \end{smallmatrix}$ ± 0.03	¹⁷ ABREU	00Y DLPH	$e^+e^- \rightarrow Z$
1.36 ± 0.09 $\begin{smallmatrix} +0.06 \\ -0.05 \end{smallmatrix}$	¹⁸ ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
1.50 $\begin{smallmatrix} +0.16 \\ -0.15 \end{smallmatrix}$ ± 0.04	¹⁸ ACKERSTAFF	98G OPAL	$e^+e^- \rightarrow Z$
1.54 $\begin{smallmatrix} +0.14 \\ -0.13 \end{smallmatrix}$ ± 0.04	¹⁸ BUSKULIC	96M ALEP	$e^+e^- \rightarrow Z$

¹⁶ Measured using $D_s^- \mu^+$ vertices.¹⁷ Uses $D_s^- \ell^+$, and $\phi \ell^+$ vertices.¹⁸ Measured using $D_s^- \ell^+$ vertices. **B_s^0 MEAN LIFE ($B_s \rightarrow J/\psi \phi$)**

VALUE (10^{-12} s)	DOCUMENT ID	TECN	COMMENT
1.429 ± 0.088	OUR EVALUATION		
$1.42^{+0.08}_{-0.07}$	OUR AVERAGE		
$1.444^{+0.098}_{-0.090} \pm 0.020$	¹⁹ ABAZOV	05B D0	$p\bar{p}$ at 1.96 TeV
$1.40^{+0.15}_{-0.13} \pm 0.02$	²⁰ ACOSTA	05 CDF	$p\bar{p}$ at 1.96 TeV
$1.34^{+0.23}_{-0.19} \pm 0.05$	²⁰ ABE	98B CDF	$p\bar{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.39^{+0.13}_{-0.16}^{+0.01}_{-0.02}$	²⁰ ABAZOV	05W D0	$p\bar{p}$ at 1.96 TeV
$1.34^{+0.23}_{-0.19} \pm 0.05$	²¹ ABE	96N CDF	Repl. by ABE 98B
¹⁹ Measured using fully reconstructed $B_s \rightarrow J/\psi(1S)\phi$ decays.			
²⁰ Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi \phi$ decays.			
²¹ ABE 96N uses 58 ± 12 exclusive $B_s \rightarrow J/\psi(1S)\phi$ events.			

 $\tau_{B_s^0}/\tau_{B^0}$ MEAN LIFE RATIO **$\tau_{B_s^0}/\tau_{B^0}$ (direct measurements)**

VALUE	DOCUMENT ID	TECN	COMMENT
$1.052 \pm 0.061 \pm 0.015$	²² ABAZOV	09E D0	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.980^{+0.076}_{-0.071} \pm 0.003$	²³ ABAZOV	05B D0	Repl. by ABAZOV 05W
$0.91 \pm 0.09 \pm 0.003$	²⁴ ABAZOV	05W D0	Repl. by ABAZOV 09E
²² Measured the angular and lifetime parameters for the time-dependent angular untagged decays $B_d^0 \rightarrow J/\psi K^{*0}$ and $B_s^0 \rightarrow J/\psi \phi$.			
²³ Measured mean life ratio using fully reconstructed decays.			
²⁴ Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi \phi$ decays.			

 B_{sH}^0 MEAN LIFE B_{sH}^0 is the heavy mass state of two B_s^0 CP eigenstates.

"OUR EVALUATION" has been obtained by the Heavy Flavor Averaging Group (HFAG) using the constraint of the flavor-specific lifetime oaverage in a way similar to $\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$.

VALUE (10^{-12} s)	DOCUMENT ID	TECN	COMMENT
1.543^{+0.058}_{-0.060} OUR EVALUATION			
1.437^{+0.054}_{-0.047}	^{25,26} AALTONEN	08J CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.58 ^{+0.39} _{-0.42} ^{+0.01} _{-0.02}	²⁶ ABAZOV	05W D0	Repl. by ABAZOV 08AM
2.07 ^{+0.58} _{-0.46} ± 0.03	²⁶ ACOSTA	05 CDF	Repl. by AALTONEN 08J
²⁵ Obtained from $\Delta\Gamma_s$ and Γ_s fit with a correlation of 0.6.			
²⁶ Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.			

B_{sL}^0 MEAN LIFE

B_{sL}^0 is the light state of two B_s^0 CP eigenstates.

"OUR EVALUATION" has been obtained by the Heavy Flavor Averaging Group (HFAG) using the constraint of the flavor-specific lifetime oaverage in a way similar to $\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$.

VALUE (10^{-12} s)	DOCUMENT ID	TECN	COMMENT
1.408^{+0.033}_{-0.030} OUR EVALUATION			
1.613^{+0.123}_{-0.113}	^{27,28} AALTONEN	08J CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.24 ^{+0.14} _{-0.11} ^{+0.01} _{-0.02}	²⁸ ABAZOV	05W D0	Repl. by ABAZOV 08AM
1.05 ^{+0.16} _{-0.13} ± 0.02	²⁸ ACOSTA	05 CDF	Repl. by AALTONEN 08J
1.27 ± 0.33 ± 0.08	²⁹ BARATE	00K ALEP	$e^+e^- \rightarrow Z$
²⁷ Obtained from $\Delta\Gamma_s$ and Γ_s fit with a correlation of 0.6.			
²⁸ Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.			
²⁹ Uses $\phi\phi$ correlations from $B_s^0 \rightarrow D_s^{(*)+} D_s^{(*)-}$.			

$\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$

$\Gamma_{B_s^0}$ and $\Delta\Gamma_{B_s^0}$ are the decay rate average and difference between two B_s^0 CP eigenstates (light – heavy).

"OUR EVALUATION" is an average of all available B_s flavor-specific lifetime measurements with the $\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$ analyses performed by the Heavy Flavor Averaging Group (HFAG) as described in our "Review on B - \bar{B} Mixing" in the B^0 Section of these Listings. The corresponding 95% CL is $-0.020 < \Delta\Gamma_{B_s^0}/\Gamma_{B_s^0} < 0.193$.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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0.092^{+0.051}_{-0.054} OUR EVALUATION

0.116 ^{+0.09} _{-0.10} ±0.010		³⁰ AALTONEN 08J	CDF	$p\bar{p}$ at 1.96 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.24 ^{+0.28} _{-0.38} ±0.03 _{-0.04}		^{30,31} ABAZOV 05W	D0	Repl. by ABAZOV 08AM
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0.65 ^{+0.25} _{-0.33} ±0.01		³⁰ ACOSTA 05	CDF	Repl. by AALTONEN 08J
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<0.46	95	³² ABREU 00Y	DLPH	$e^+e^- \rightarrow Z$
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<0.69	95	³³ ABREU,P 00G	DLPH	$e^+e^- \rightarrow Z$
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<0.83	95	³⁴ ABE 99D	CDF	$p\bar{p}$ at 1.8 TeV
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<0.67	95	³⁵ ACCIARRI 98S	L3	$e^+e^- \rightarrow Z$
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³⁰ Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.

³¹ Uses $|A_0|^2 - |A_{||}|^2 = 0.355 \pm 0.066$ from ACOSTA 05.

³² Uses $D_s^- \ell^+$, and $\phi \ell^+$ vertices.

³³ Measured using D_s hadron vertices.

³⁴ ABE 99D assumes $\tau_{B_s^0} = 1.55 \pm 0.05$ ps.

³⁵ ACCIARRI 98S assumes $\tau_{B_s^0} = 1.49 \pm 0.06$ ps and PDG 98 values of b production fraction.

 $\Delta\Gamma_{B_s^0}$

"OUR EVALUATION" has been obtained by the Heavy Flavor Averaging Group (HFAG) using the constraint of the flavor-specific lifetime oaverage in a way similar to $\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$.

VALUE (10^{12} s^{-1})	DOCUMENT ID	TECN	COMMENT
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0.062^{+0.034}_{-0.037} OUR EVALUATION

0.12 ±0.06 OUR AVERAGE Error includes scale factor of 1.2.

0.076 ^{+0.059} _{-0.063} ±0.006		³⁶ AALTONEN 08J	CDF	$p\bar{p}$ at 1.96 TeV
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0.19 ±0.07 ^{+0.02} _{-0.01}		^{37,38} ABAZOV 08AMD0		$p\bar{p}$ at 1.96 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.085 ^{+0.072} _{-0.078} ±0.001		³⁹ ABAZOV 09E	D0	Repl. by ABAZOV 08AM
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0.12 ^{+0.08} _{-0.10} ±0.02		^{36,40} ABAZOV 07	D0	Repl. by ABAZOV 07N
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0.13 ±0.09		⁴¹ ABAZOV 07N	D0	Repl. by ABAZOV 09E
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0.47 ^{+0.19} _{-0.24} ±0.01		³⁶ ACOSTA 05	CDF	Repl. by AALTONEN 08J
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- ³⁶ Measured using the time-dependent angular analysis of $B_S^0 \rightarrow J/\psi \phi$ decays and assuming CP -violating phase $\phi_S = 0$.
- ³⁷ Measured using fully reconstructed $B_S \rightarrow J/\psi \phi$ decays.
- ³⁸ Obtains 90% CL interval $-0.06 < \Delta\Gamma_S < 0.30$.
- ³⁹ Measured the angular and lifetime parameters for the time-dependent angular untagged decays $B_d^0 \rightarrow J/\psi K^{*0}$ and $B_S^0 \rightarrow J/\psi \phi$.
- ⁴⁰ ABAZOV 07 reports $0.17 \pm 0.09 \pm 0.02$ with CP -violating phase ϕ_S as a free parameter.
- ⁴¹ Combines D^0 measurements of time-dependent angular distributions in $B_S^0 \rightarrow J/\psi \phi$ and charge asymmetry in semileptonic decays. There is a 4-fold ambiguity in the solution.

$\Delta\Gamma_S^{CP} / \Gamma_S$

Γ_S and $\Delta\Gamma_S^{CP}$ are the decay rate average and difference between even, $\Gamma_S^{CP-even}$, and odd, Γ_S^{CP-odd} , CP eigenstates.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.080 ± 0.030 OUR AVERAGE				
$0.072 \pm 0.021 \pm 0.022$		⁴² ABAZOV	09I D0	$p\bar{p}$ at 1.96 TeV
$0.25^{+0.21}_{-0.14}$		⁴³ BARATE	00K ALEP	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>0.012	95	⁴² AALTONEN	08F CDF	$p\bar{p}$ at 1.96 TeV
$0.079^{+0.038+0.031}_{-0.035-0.030}$		⁴² ABAZOV	07Y D0	Repl. by ABAZOV 09I
⁴² Assumes $2 \text{ B}(B_S^0 \rightarrow D_S^{(*)} D_S^{(*)}) \simeq \Delta\Gamma_S^{CP} / \Gamma_S$.				
⁴³ Uses $\phi\phi$ correlations from $B_S^0 \rightarrow D_S^{(*)+} D_S^{(*)-}$.				

$1 / \Gamma_{B_S^0}$

"OUR EVALUATION" has been obtained by the Heavy Flavor Averaging Group (HFAG) using the constraint of the flavor-specific lifetime oaverage in a way similar to $\Delta\Gamma_{B_S^0} / \Gamma_{B_S^0}$.

VALUE (10^{-12} s)	DOCUMENT ID	TECN	COMMENT
$1.472^{+0.024}_{-0.026}$ OUR EVALUATION			
1.520 ± 0.034 OUR AVERAGE			
$1.52 \pm 0.04 \pm 0.02$	⁴⁴ AALTONEN	08J CDF	$p\bar{p}$ at 1.96 TeV
$1.52 \pm 0.05 \pm 0.01$	⁴⁴ ABAZOV	08AMD0	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.487 \pm 0.060 \pm 0.028$	⁴⁴ ABAZOV	09E D0	Repl. by ABAZOV 08AM
⁴⁴ Measured using the time-dependent angular analysis of $B_S^0 \rightarrow J/\psi \phi$ decays.			

B_s^0 DECAY MODES

These branching fractions all scale with $B(\bar{b} \rightarrow B_s^0)$, the LEP B_s^0 production fraction. The first four were evaluated using $B(\bar{b} \rightarrow B_s^0) = (10.7 \pm 1.2)\%$ and the rest assume $B(\bar{b} \rightarrow B_s^0) = 12\%$.

The branching fraction $B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{ anything})$ is not a pure measurement since the measured product branching fraction $B(\bar{b} \rightarrow B_s^0) \times B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{ anything})$ was used to determine $B(\bar{b} \rightarrow B_s^0)$, as described in the note on “ B^0 - \bar{B}^0 Mixing”

For inclusive branching fractions, *e.g.*, $B \rightarrow D^\pm \text{ anything}$, the values usually are multiplicities, not branching fractions. They can be greater than one.

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D_s^- \text{ anything}$	(93 \pm 25) %	
Γ_2 $D_s^- \ell^+ \nu_\ell \text{ anything}$	[a] (7.9 \pm 2.4) %	
Γ_3 $D_{s1}(2536)^- \mu^+ \nu_\mu X \times$ $B(D_{s1}^- \rightarrow D^{*-} K_S^0)$	(2.4 \pm 0.7) $\times 10^{-3}$	
Γ_4 $D_s^- \pi^+$	(3.2 \pm 0.5) $\times 10^{-3}$	
Γ_5 $D_s^- \pi^+ \pi^+ \pi^-$	(8.4 \pm 3.3) $\times 10^{-3}$	
Γ_6 $D_s^\mp K^\pm$	(3.0 \pm 0.7) $\times 10^{-4}$	
Γ_7 $D_s^+ D_s^-$	(1.04 \pm 0.35) %	
Γ_8 $D_s^{*+} D_s^-$	< 12.1 %	90%
Γ_9 $D_s^{*+} D_s^{*-}$	< 25.7 %	90%
Γ_{10} $D_s^{(*)+} D_s^{(*)-}$	(4.0 \pm 1.5) %	
Γ_{11} $J/\psi(1S) \phi$	(1.3 \pm 0.4) $\times 10^{-3}$	
Γ_{12} $J/\psi(1S) \pi^0$	< 1.2 $\times 10^{-3}$	90%
Γ_{13} $J/\psi(1S) \eta$	< 3.8 $\times 10^{-3}$	90%
Γ_{14} $\psi(2S) \phi$	(6.8 \pm 2.7) $\times 10^{-4}$	
Γ_{15} $\pi^+ \pi^-$	< 1.2 $\times 10^{-6}$	90%
Γ_{16} $\pi^0 \pi^0$	< 2.1 $\times 10^{-4}$	90%
Γ_{17} $\eta \pi^0$	< 1.0 $\times 10^{-3}$	90%
Γ_{18} $\eta \eta$	< 1.5 $\times 10^{-3}$	90%
Γ_{19} $\rho^0 \rho^0$	< 3.20 $\times 10^{-4}$	90%
Γ_{20} $\phi \rho^0$	< 6.17 $\times 10^{-4}$	90%
Γ_{21} $\phi \phi$	(1.4 \pm 0.8) $\times 10^{-5}$	
Γ_{22} $\pi^+ K^-$	(4.9 \pm 1.0) $\times 10^{-6}$	
Γ_{23} $K^+ K^-$	(3.3 \pm 0.9) $\times 10^{-5}$	
Γ_{24} $\bar{K}^*(892)^0 \rho^0$	< 7.67 $\times 10^{-4}$	90%
Γ_{25} $\bar{K}^*(892)^0 K^*(892)^0$	< 1.681 $\times 10^{-3}$	90%

Γ_{26}	$\phi K^*(892)^0$		< 1.013	$\times 10^{-3}$	90%
Γ_{27}	$p\bar{p}$		< 5.9	$\times 10^{-5}$	90%
Γ_{28}	$\gamma\gamma$	<i>B1</i>	< 8.7	$\times 10^{-6}$	90%
Γ_{29}	$\phi\gamma$		$(5.7 \pm_{-1.9}^{+2.2})$	$\times 10^{-5}$	

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

Γ_{30}	$\mu^+ \mu^-$	<i>B1</i>	< 4.7	$\times 10^{-8}$	90%
Γ_{31}	$e^+ e^-$	<i>B1</i>	< 2.8	$\times 10^{-7}$	90%
Γ_{32}	$e^\pm \mu^\mp$	<i>LF</i> [b]	< 2.0	$\times 10^{-7}$	90%
Γ_{33}	$\phi(1020)\mu^+ \mu^-$	<i>B1</i>	< 3.2	$\times 10^{-6}$	90%
Γ_{34}	$\phi\nu\bar{\nu}$	<i>B1</i>	< 5.4	$\times 10^{-3}$	90%

[a] Not a pure measurement. See note at head of B_s^0 Decay Modes.

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

B_s^0 BRANCHING RATIOS

$\Gamma(D_s^- \text{ anything})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.93\pm0.25 OUR AVERAGE				
0.91 \pm 0.18 \pm 0.41		⁴⁵ DRUTSKOY 07	BELL	$e^+ e^- \rightarrow \Upsilon(4S)$
0.81 \pm 0.24 \pm 0.22	90	⁴⁶ BUSKULIC 96E	ALEP	$e^+ e^- \rightarrow Z$
1.56 \pm 0.58 \pm 0.44	147	⁴⁷ ACTON 92N	OPAL	$e^+ e^- \rightarrow Z$

⁴⁵ The extraction of this result takes into account the correlation between the measurements of $B(\Upsilon(5S) \rightarrow D_s X)$ and $B(\Upsilon(5S) \rightarrow D^0 X)$.

⁴⁶ BUSKULIC 96E separate $c\bar{c}$ and $b\bar{b}$ sources of D_s^+ mesons using a lifetime tag, subtract generic $\bar{b} \rightarrow W^+ \rightarrow D_s^+$ events, and obtain $B(\bar{b} \rightarrow B_s^0) \times B(B_s^0 \rightarrow D_s^- \text{ anything}) = 0.088 \pm 0.020 \pm 0.020$ assuming $B(D_s \rightarrow \phi\pi) = (3.5 \pm 0.4) \times 10^{-2}$ and PDG 1994 values for the relative partial widths to other D_s channels. We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$. Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$.

⁴⁷ ACTON 92N assume that excess of 147 ± 48 D_s^0 events over that expected from B^0 , B^+ , and $c\bar{c}$ is all from B_s^0 decay. The product branching fraction is measured to be $B(\bar{b} \rightarrow B_s^0)B(B_s^0 \rightarrow D_s^- \text{ anything}) \times B(D_s^- \rightarrow \phi\pi^-) = (5.9 \pm 1.9 \pm 1.1) \times 10^{-3}$. We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$. Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$.

$\Gamma(D_s^- \ell^+ \nu_\ell \text{ anything}) / \Gamma_{\text{total}}$ Γ_2 / Γ

The values and averages in this section serve only to show what values result if one assumes our $B(\bar{b} \rightarrow B_s^0)$. They cannot be thought of as measurements since the underlying product branching fractions were also used to determine $B(\bar{b} \rightarrow B_s^0)$ as described in the note on “Production and Decay of b -Flavored Hadrons.”

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.079 ± 0.024 OUR AVERAGE				
0.076 ± 0.012 ± 0.021	134	48 BUSKULIC	95O ALEP	$e^+ e^- \rightarrow Z$
0.107 ± 0.043 ± 0.029		49 ABREU	92M DLPH	$e^+ e^- \rightarrow Z$
0.103 ± 0.036 ± 0.028	18	50 ACTON	92N OPAL	$e^+ e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.13 ± 0.04 ± 0.04	27	51 BUSKULIC	92E ALEP	$e^+ e^- \rightarrow Z$

48 BUSKULIC 95O use $D_s \ell$ correlations. The measured product branching ratio is $B(\bar{b} \rightarrow B_s) \times B(B_s \rightarrow D_s^- \ell^+ \nu_\ell \text{ anything}) = (0.82 \pm 0.09^{+0.13}_{-0.14})\%$ assuming $B(D_s \rightarrow \phi\pi) = (3.5 \pm 0.4) \times 10^{-2}$ and PDG 1994 values for the relative partial widths to the six other D_s channels used in this analysis. Combined with results from $\Upsilon(4S)$ experiments this can be used to extract $B(\bar{b} \rightarrow B_s) = (11.0 \pm 1.2^{+2.5}_{-2.6})\%$. We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$. Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$.

49 ABREU 92M measured muons only and obtained product branching ratio $B(Z \rightarrow b \text{ or } \bar{b}) \times B(\bar{b} \rightarrow B_s) \times B(B_s \rightarrow D_s \mu^+ \nu_\mu \text{ anything}) \times B(D_s \rightarrow \phi\pi) = (18 \pm 8) \times 10^{-5}$. We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$. Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$. We use $B(Z \rightarrow b \text{ or } \bar{b}) = 2B(Z \rightarrow b\bar{b}) = 2 \times (0.2212 \pm 0.0019)$.

50 ACTON 92N is measured using $D_s \rightarrow \phi\pi^+$ and $K^*(892)^0 K^+$ events. The product branching fraction measured is measured to be $B(\bar{b} \rightarrow B_s^0)B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{ anything}) \times B(D_s^- \rightarrow \phi\pi^-) = (3.9 \pm 1.1 \pm 0.8) \times 10^{-4}$. We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$. Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$.

51 BUSKULIC 92E is measured using $D_s \rightarrow \phi\pi^+$ and $K^*(892)^0 K^+$ events. They use $2.7 \pm 0.7\%$ for the $\phi\pi^+$ branching fraction. The average product branching fraction is measured to be $B(\bar{b} \rightarrow B_s^0)B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{ anything}) = 0.020 \pm 0.0055^{+0.005}_{-0.006}$. We evaluate using our current values $B(\bar{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ and $B(D_s \rightarrow \phi\pi) = 0.036 \pm 0.009$. Our first error is their experiment's and our second error is that due to $B(\bar{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$. Superseded by BUSKULIC 95O.

 $\Gamma(D_{s1}(2536)^- \mu^+ \nu_\mu X \times B(D_{s1}^- \rightarrow D^{*-} K_S^0)) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.4 ± 0.6 ± 0.3	52 ABAZOV	09G D0	$p\bar{p}$ at 1.96 TeV

52 ABAZOV 09G reports $[\Gamma(B_s^0 \rightarrow D_{s1}(2536)^- \mu^+ \nu_\mu X \times B(D_{s1}^- \rightarrow D^{*-} K_S^0)) / \Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow B_s^0)] = (2.66 \pm 0.52 \pm 0.45) \times 10^{-4}$ which we divide by our best value $B(\bar{b} \rightarrow B_s^0) = (11.3 \pm 1.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^- \pi^+)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.2 ± 0.5 OUR FIT				
3.3 ± 0.5 OUR AVERAGE				
$3.7^{+0.6}_{-0.5} \pm 0.6$	53	LOUVOT	09	BELL $e^+ e^- \rightarrow \gamma(5S)$
$3.0 \pm 0.7 \pm 0.1$	54	ABULENCIA	07C	CDF $p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$6.8 \pm 2.2 \pm 1.6$		DRUTSKOY	07A	BELL Repl. by LOUVOT 09
$3.5 \pm 1.1 \pm 0.2$	55	ABULENCIA	06J	CDF Repl. by ABULENCIA 07C
<130	6	56 AKERS	94J	OPAL $e^+ e^- \rightarrow Z$
seen	1	BUSKULIC	93G	ALEP $e^+ e^- \rightarrow Z$
53 LOUVOT 09 reports $(3.67^{+0.35+0.65}_{-0.33-0.645}) \times 10^{-3}$ from a measurement of $[\Gamma(B_s^0 \rightarrow D_s^- \pi^+)/\Gamma_{\text{total}}] \times [B(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)})]$ assuming $B(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.5 \pm 2.6) \times 10^{-2}$, which we rescale to our best value $B(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.3 \pm 2.9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
54 ABULENCIA 07C reports $[\Gamma(B_s^0 \rightarrow D_s^- \pi^+)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^- \pi^+)] = 1.13 \pm 0.08 \pm 0.23$ which we multiply by our best value $B(B^0 \rightarrow D^- \pi^+) = (2.68 \pm 0.13) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
55 ABULENCIA 06J reports $[\Gamma(B_s^0 \rightarrow D_s^- \pi^+)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^- \pi^+)] = 1.32 \pm 0.18 \pm 0.38$ which we multiply by our best value $B(B^0 \rightarrow D^- \pi^+) = (2.68 \pm 0.13) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
56 AKERS 94J sees ≤ 6 events and measures the limit on the product branching fraction $f(\bar{b} \rightarrow B_s^0) \cdot B(B_s^0 \rightarrow D_s^- \pi^+) < 1.3\%$ at CL = 90%. We divide by our current value $B(\bar{b} \rightarrow B_s^0) = 0.105$.				

 $\Gamma(D_s^- \pi^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$8.4 \pm 1.9 \pm 2.7$	57	ABULENCIA	07C CDF $p\bar{p}$ at 1.96 TeV
57 ABULENCIA 07C reports $[\Gamma(B_s^0 \rightarrow D_s^- \pi^+ \pi^+ \pi^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^- \pi^+ \pi^+ \pi^-)] = 1.05 \pm 0.10 \pm 0.22$ which we multiply by our best value $B(B^0 \rightarrow D^- \pi^+ \pi^+ \pi^-) = (8.0 \pm 2.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

 $\Gamma(D_s^\mp K^\pm)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.0 ± 0.7 OUR FIT			
$2.4^{+1.2}_{-1.0} \pm 0.4$	58	LOUVOT	09 BELL $e^+ e^- \rightarrow \gamma(5S)$
58 LOUVOT 09 reports $(2.4^{+1.2}_{-1.0} \pm 0.42) \times 10^{-4}$ from a measurement of $[\Gamma(B_s^0 \rightarrow D_s^\mp K^\pm)/\Gamma_{\text{total}}] \times [B(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)})]$ assuming $B(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.5 \pm 2.6) \times 10^{-2}$, which we rescale to our best value $B(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.3 \pm 2.9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

$\Gamma(D_s^\mp K^\pm)/\Gamma(D_s^- \pi^+)$ Γ_6/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
0.092±0.018 OUR FIT			
0.097±0.018±0.009	AALTONEN	09AQ CDF	$p\bar{p}$ at 1.96 TeV

 $\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
10.4^{+3.5}_{-3.2}±1.1		⁵⁹ AALTONEN	08F CDF	$p\bar{p}$ at 1.96 TeV

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

<67 90 DRUTSKOY 07A BELL $e^+e^- \rightarrow \Upsilon(5S)$

⁵⁹ AALTONEN 08F reports $[\Gamma(B_s^0 \rightarrow D_s^+ D_s^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^- D_s^+)] = 1.44^{+0.48}_{-0.44}$ which we multiply by our best value $B(B^0 \rightarrow D^- D_s^+) = (7.2 \pm 0.8) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(D_s^{*+} D_s^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.121	90	DRUTSKOY	07A BELL	$e^+e^- \rightarrow \Upsilon(5S)$

 $\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.257	90	DRUTSKOY	07A BELL	$e^+e^- \rightarrow \Upsilon(5S)$

 $\Gamma(D_s^{(*)+} D_s^{(*)-})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.040±0.015 OUR AVERAGE				
0.035±0.010±0.011		⁶⁰ ABAZOV	09I D0	$p\bar{p}$ at 1.96 TeV
0.14 ±0.06 ±0.03		^{61,62} BARATE	00K ALEP	$e^+e^- \rightarrow Z$

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

0.039^{+0.019+0.016}_{-0.017-0.015} ⁶⁰ ABAZOV 07Y D0 Repl. by ABAZOV 09I

<0.218 90 BARATE 98Q ALEP $e^+e^- \rightarrow Z$

⁶⁰ Uses the final states where $D_s^+ \rightarrow \phi\pi^+$ and $D_s^- \rightarrow \phi\mu^- \bar{\nu}_\mu$.

⁶¹ Reports $B(B_s^0(\text{short}) \rightarrow D_s^{(*)+} D_s^{(*)-}) = (0.23 \pm 0.10 \pm 0.05) \cdot [0.17/B(D_s \rightarrow \phi\chi)]^2$ assuming $B(B_s^0 \rightarrow B_s^0(\text{short})) = 50\%$. We use our best value of $B(D_s \rightarrow \phi\chi) = 15.7 \pm 1.0\%$ to obtain the quoted result.

⁶² Uses $\phi\phi$ correlations from $B_s^0(\text{short}) \rightarrow D_s^{(*)+} D_s^{(*)-}$.

 $\Gamma(J/\psi(1S)\phi)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3±0.4±0.2		⁶³ ABE	96Q CDF	$p\bar{p}$

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

<6 1 ⁶⁴ AKERS 94J OPAL $e^+e^- \rightarrow Z$

seen 14 ⁶⁵ ABE 93F CDF $p\bar{p}$ at 1.8 TeV

seen 1 ⁶⁶ ACTON 92N OPAL Sup. by AKERS 94J

⁶³ ABE 96Q reports $[\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)/\Gamma_{\text{total}}] \times [\Gamma(\bar{b} \rightarrow B_S^0)/[\Gamma(\bar{b} \rightarrow B^+) + \Gamma(\bar{b} \rightarrow B^0)]] = (0.185 \pm 0.055 \pm 0.020) \times 10^{-3}$ which we divide by our best value $\Gamma(\bar{b} \rightarrow B_S^0)/[\Gamma(\bar{b} \rightarrow B^+) + \Gamma(\bar{b} \rightarrow B^0)] = 0.142 \pm 0.017$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁶⁴ AKERS 94J sees one event and measures the limit on the product branching fraction $f(\bar{b} \rightarrow B_S^0) \cdot B(B_S^0 \rightarrow J/\psi(1S)\phi) < 7 \times 10^{-4}$ at CL = 90%. We divide by $B(\bar{b} \rightarrow B_S^0) = 0.112$.

⁶⁵ ABE 93F measured using $J/\psi(1S) \rightarrow \mu^+\mu^-$ and $\phi \rightarrow K^+K^-$.

⁶⁶ In ACTON 92N a limit on the product branching fraction is measured to be $f(\bar{b} \rightarrow B_S^0) \cdot B(B_S^0 \rightarrow J/\psi(1S)\phi) \leq 0.22 \times 10^{-2}$.

$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$

Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN
$< 1.2 \times 10^{-3}$	90	⁶⁷ ACCIARRI	97C L3

⁶⁷ ACCIARRI 97C assumes B^0 production fraction $(39.5 \pm 4.0\%)$ and B_S $(12.0 \pm 3.0\%)$.

$\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$

Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID	TECN
$< 3.8 \times 10^{-3}$	90	⁶⁸ ACCIARRI	97C L3

⁶⁸ ACCIARRI 97C assumes B^0 production fraction $(39.5 \pm 4.0\%)$ and B_S $(12.0 \pm 3.0\%)$.

$\Gamma(\psi(2S)\phi)/\Gamma_{\text{total}}$

Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	1	BUSKULIC	93G ALEP	$e^+e^- \rightarrow Z$

$\Gamma(\psi(2S)\phi)/\Gamma(J/\psi(1S)\phi)$

Γ_{14}/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT
0.53 ± 0.10 OUR AVERAGE			
0.53 ± 0.10 ± 0.09	ABAZOV	09Y D0	$p\bar{p}$ at 1.96 TeV
0.52 ± 0.13 ± 0.07	ABULENCIA	06N CDF	$p\bar{p}$ at 1.96 TeV

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

Γ_{15}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2	90	⁶⁹ AALTONEN	09C CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 1.7	90	⁷⁰ ABULENCIA,A 06D	CDF	Repl. by AALTONEN 09C
< 232	90	⁷¹ ABE	00C SLD	$e^+e^- \rightarrow Z$
< 170	90	⁷² BUSKULIC	96V ALEP	$e^+e^- \rightarrow Z$

⁶⁹ Obtains this result from $(f_s/f_d) \cdot B(B_S \rightarrow \pi^+\pi^-)/B(B^0 \rightarrow K^+\pi^-) = 0.007 \pm 0.004 \pm 0.005$, assuming $f_s/f_d = 0.276 \pm 0.034$ and $B(B^0 \rightarrow K^+\pi^-) = (19.4 \pm 0.6) \times 10^{-6}$.

⁷⁰ ABULENCIA,A 06D obtains this from $B(B_S \rightarrow \pi^+\pi^-) / B(B_S \rightarrow K^+K^-) < 0.05$ at 90% CL, assuming $B(B_S \rightarrow K^+K^-) = (33 \pm 6 \pm 7) \times 10^{-6}$.

⁷¹ ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the B fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$.

⁷² BUSKULIC 96V assumes PDG 96 production fractions for B^0 , B^+ , B_s , b baryons.

$\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-4}$	90	⁷³ ACCIARRI	95H L3	$e^+e^- \rightarrow Z$

⁷³ ACCIARRI 95H assumes $f_{B^0} = 39.5 \pm 4.0$ and $f_{B_s} = 12.0 \pm 3.0\%$.

 $\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.0 \times 10^{-3}$	90	⁷⁴ ACCIARRI	95H L3	$e^+e^- \rightarrow Z$

⁷⁴ ACCIARRI 95H assumes $f_{B^0} = 39.5 \pm 4.0$ and $f_{B_s} = 12.0 \pm 3.0\%$.

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.5 \times 10^{-3}$	90	⁷⁵ ACCIARRI	95H L3	$e^+e^- \rightarrow Z$

⁷⁵ ACCIARRI 95H assumes $f_{B^0} = 39.5 \pm 4.0$ and $f_{B_s} = 12.0 \pm 3.0\%$.

 $\Gamma(\rho^0\rho^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.20 \times 10^{-4}$	90	⁷⁶ ABE	00C SLD	$e^+e^- \rightarrow Z$

⁷⁶ ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the B fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$.

 $\Gamma(\phi\rho^0)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.17 \times 10^{-4}$	90	⁷⁷ ABE	00C SLD	$e^+e^- \rightarrow Z$

⁷⁷ ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the B fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$.

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
$14^{+6}_{-5} \pm 6$		⁷⁸ ACOSTA	05J CDF	$p\bar{p}$ at 1.96 TeV

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

<1183	90	⁷⁹ ABE	00C SLD	$e^+e^- \rightarrow Z$
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⁷⁸ Uses $B(B^0 \rightarrow J/\psi\phi) = (1.38 \pm 0.49) \times 10^{-3}$ and production cross-section ratio of $\sigma(B_s)/\sigma(B^0) = 0.26 \pm 0.04$.

⁷⁹ ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the B fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$.

 $\Gamma(\pi^+K^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
$4.9 \pm 0.8 \pm 0.6$		⁸⁰ AALTONEN	09C CDF	$p\bar{p}$ at 1.96 TeV

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

< 5.6	90	81	ABULENCIA,A 06D	CDF	Repl. by AALTONEN 09C
<261	90	82	ABE	00C	SLD $e^+e^- \rightarrow Z$
<210	90	83	BUSKULIC	96V	ALEP $e^+e^- \rightarrow Z$
<260	90	84	AKERS	94L	OPAL $e^+e^- \rightarrow Z$

⁸⁰ AALTONEN 09C reports $[\Gamma(B_s^0 \rightarrow \pi^+ K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^+ \pi^-)] \times [B(\bar{b} \rightarrow B_s^0)] / [B(\bar{b} \rightarrow B^0)] = 0.071 \pm 0.010 \pm 0.007$ which we multiply or divide by our best values $B(B^0 \rightarrow K^+ \pi^-) = (1.94 \pm 0.06) \times 10^{-5}$, $B(\bar{b} \rightarrow B_s^0) = (11.3 \pm 1.3) \times 10^{-2}$, $B(\bar{b} \rightarrow B^0) = (40.1 \pm 1.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

⁸¹ ABULENCIA,A 06D obtains this from $(f_s/f_d) (B(B_s \rightarrow \pi^+ K^-) / B(B^0 \rightarrow K^+ \pi^-)) < 0.08$ at 90% CL, assuming $f_s/f_d = 0.260 \pm 0.039$ and $B(B^0 \rightarrow K^+ \pi^-) = (18.9 \pm 0.7) \times 10^{-6}$.

⁸² ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the B fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$.

⁸³ BUSKULIC 96V assumes PDG 96 production fractions for B^0 , B^+ , B_s , b baryons.

⁸⁴ Assumes $B(Z \rightarrow b\bar{b}) = 0.217$ and B_d^0 (B_s^0) fraction 39.5% (12%).

$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$

Γ_{23}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
$3.3 \pm 0.6 \pm 0.7$		⁸⁵ ABULENCIA,A 06D	CDF	$p\bar{p}$ at 1.96 TeV

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

<31	90	DRUTSKOY	07A	BELL	$e^+e^- \rightarrow \gamma(5S)$
<28.3	90	ABE	00C	SLD	$e^+e^- \rightarrow Z$
< 5.9	90	87 BUSKULIC	96V	ALEP	$e^+e^- \rightarrow Z$
<14	90	88 AKERS	94L	OPAL	$e^+e^- \rightarrow Z$

⁸⁵ ABULENCIA,A 06D obtains this from $(f_s/f_d) (B(B_s \rightarrow K^+ K^-) / B(B^0 \rightarrow K^+ \pi^-)) = 0.46 \pm 0.08 \pm 0.07$, assuming $f_s/f_d = 0.260 \pm 0.039$ and $B(B^0 \rightarrow K^+ \pi^-) = (18.9 \pm 0.7) \times 10^{-6}$.

⁸⁶ ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the B fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$.

⁸⁷ BUSKULIC 96V assumes PDG 96 production fractions for B^0 , B^+ , B_s , b baryons.

⁸⁸ Assumes $B(Z \rightarrow b\bar{b}) = 0.217$ and B_d^0 (B_s^0) fraction 39.5% (12%).

$\Gamma(\bar{K}^*(892)^0 \rho^0)/\Gamma_{\text{total}}$

Γ_{24}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.67 \times 10^{-4}$	90	⁸⁹ ABE	00C	SLD $e^+e^- \rightarrow Z$

⁸⁹ ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the B fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$.

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

Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<16.81 \times 10^{-4}$	90	⁹⁰ ABE	00C	SLD $e^+e^- \rightarrow Z$

⁹⁰ ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the B fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$.

$\Gamma(\phi K^*(892)^0)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<10.13 \times 10^{-4}$	90	⁹¹ ABE 00C	SLD	$e^+e^- \rightarrow Z$
⁹¹ ABE 00C assumes $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$ and the B fractions $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$ and $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$.				

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{27}/Γ Test for $\Delta B=1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.9 \times 10^{-5}$	90	⁹² BUSKULIC 96V	ALEP	$e^+e^- \rightarrow Z$
⁹² BUSKULIC 96V assumes PDG 96 production fractions for B^0 , B^+ , B_s , b baryons.				

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{28}/Γ Test for $\Delta B=1$ weak neutral current.

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 8.7	90	⁹³ WICHT 08A	BELL	$e^+e^- \rightarrow \gamma(5S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 53	90	DRUTSKOY 07A	BELL	Repl. by WICHT 08A
<148	90	⁹⁴ ACCIARRI 95I	L3	$e^+e^- \rightarrow Z$
⁹³ Assumes $\gamma(5S) \rightarrow B_s^* \bar{B}_s^* = (19.5^{+3.0}_{-2.3})\%$.				
⁹⁴ ACCIARRI 95I assumes $f_{B^0} = 39.5 \pm 4.0$ and $f_{B_s} = 12.0 \pm 3.0\%$.				

 $\Gamma(\phi\gamma)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
57^{+18+12}_{-15-11}		⁹⁵ WICHT 08A	BELL	$e^+e^- \rightarrow \gamma(5S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<390	90	DRUTSKOY 07A	BELL	$e^+e^- \rightarrow \gamma(5S)$
<120	90	ACOSTA 02G	CDF	$p\bar{p}$ at 1.8 TeV
<700	90	⁹⁶ ADAM 96D	DLPH	$e^+e^- \rightarrow Z$
⁹⁵ Assumes $\gamma(5S) \rightarrow B_s^* \bar{B}_s^* = (19.5^{+3.0}_{-2.3})\%$.				
⁹⁶ ADAM 96D assumes $f_{B^0} = f_{B^-} = 0.39$ and $f_{B_s} = 0.12$.				

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ Test for $\Delta B = 1$ weak neutral current.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.7 \times 10^{-8}$	90	⁹⁷ AALTONEN 08I	CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<9.4 \times 10^{-8}$	90	⁹⁸ ABAZOV 07Q	D0	$p\bar{p}$ at 1.96 TeV
$<4.1 \times 10^{-7}$	90	⁹⁹ ABAZOV 05E	D0	$p\bar{p}$ at 1.96 TeV
$<1.5 \times 10^{-7}$	90	¹⁰⁰ ABULENCIA 05	CDF	$p\bar{p}$ at 1.96 TeV
$<5.8 \times 10^{-7}$	90	¹⁰¹ ACOSTA 04D	CDF	$p\bar{p}$ at 1.96 TeV
$<2.0 \times 10^{-6}$	90	¹⁰² ABE 98	CDF	$p\bar{p}$ at 1.8 TeV
$<3.8 \times 10^{-5}$	90	¹⁰³ ACCIARRI 97B	L3	$e^+e^- \rightarrow Z$
$<8.4 \times 10^{-6}$	90	¹⁰⁴ ABE 96L	CDF	Repl. by ABE 98

- ⁹⁷ Uses B production ratio $f(\bar{b} \rightarrow B^+)/f(\bar{b} \rightarrow B_S^0) = 3.86 \pm 0.59$, and the number of $B^+ \rightarrow J/\psi K^+$ decays.
- ⁹⁸ Uses B production ratio $f(\bar{b} \rightarrow B^+)/f(\bar{b} \rightarrow B_S^0) = 3.86 \pm 0.54$ and the number of $B^+ \rightarrow J/\psi K^+$ decays.
- ⁹⁹ Assumes production cross-section $\sigma(B_S)/\sigma(B^+) = 0.270 \pm 0.034$.
- ¹⁰⁰ Assumes production cross section $\sigma(B^+)/\sigma(B_S) = 3.71 \pm 0.41$ and $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+ \mu^- K^+) = (5.88 \pm 0.26) \times 10^{-5}$.
- ¹⁰¹ Assumes production cross-section $\sigma(B_S)/\sigma(B^+) = 0.100/0.391$ and the CDF measured value of $\sigma(B^+) = 3.6 \pm 0.6 \mu\text{b}$.
- ¹⁰² ABE 98 assumes production of $\sigma(B^0) = \sigma(B^+)$ and $\sigma(B_S)/\sigma(B^0) = 1/3$. They normalize to their measured $\sigma(B^0, p_T(B) > 6, |y| < 1.0) = 2.39 \pm 0.32 \pm 0.44 \mu\text{b}$.
- ¹⁰³ ACCIARRI 97B assume PDG 96 production fractions for B^+ , B^0 , B_S , and Λ_b .
- ¹⁰⁴ ABE 96L assumes B^+/B_S production ratio 3/1. They normalize to their measured $\sigma(B^+, p_T(B) > 6 \text{ GeV}/c, |y| < 1) = 2.39 \pm 0.54 \mu\text{b}$.

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ **Γ_{31}/Γ** Test for $\Delta B = 1$ weak neutral current.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-7}$	90	AALTONEN	09P CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<5.4 \times 10^{-5}$	90	¹⁰⁵ ACCIARRI	97B L3	$e^+e^- \rightarrow Z$

¹⁰⁵ ACCIARRI 97B assume PDG 96 production fractions for B^+ , B^0 , B_S , and Λ_b .

 $\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$ **Γ_{32}/Γ**

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.0 \times 10^{-7}$	90	AALTONEN	09P CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<6.1 \times 10^{-6}$	90	ABE	98V CDF	Repl. by AALTONEN 09P
$<4.1 \times 10^{-5}$	90	¹⁰⁶ ACCIARRI	97B L3	$e^+e^- \rightarrow Z$

¹⁰⁶ ACCIARRI 97B assume PDG 96 production fractions for B^+ , B^0 , B_S , and Λ_b .

 $\Gamma(\phi(1020)\mu^+\mu^-)/\Gamma_{\text{total}}$ **Γ_{33}/Γ** Test for $\Delta B = 1$ weak neutral current.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.2 \times 10^{-6}$	90	¹⁰⁷ ABAZOV	06G D0	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<5 \times 10^{-6}$	90	¹⁰⁸ AALTONEN	09B CDF	$p\bar{p}$ at 1.96 TeV
$<4.7 \times 10^{-5}$	90	ACOSTA	02D CDF	$p\bar{p}$ at 1.8 TeV

¹⁰⁷ Uses $B(B_S^0 \rightarrow J/\psi \phi) = 9.3 \times 10^{-4}$.

¹⁰⁸ AALTONEN 09B reports $B(B_S^0 \rightarrow \phi \mu^+ \mu^-) / B(B_S^0 \rightarrow J/\psi \phi) < 2.3 \times 10^{-3}$ at 90% CL. It uses $B(B_S^0 \rightarrow J/\psi \phi) = (1.38 \pm 0.49) \times 10^{-3}$ to compute the limit. This limit is equivalent to $B(B_S^0 \rightarrow \mu^+ \mu^- \phi) = (1.70 \pm 0.82 \pm 0.64) \times 10^{-6}$.

$\Gamma(\phi\nu\bar{\nu})/\Gamma_{\text{total}}$ Γ_{34}/Γ Test for $\Delta B = 1$ weak neutral current.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.4 \times 10^{-3}$	90	¹⁰⁹ ADAM	96D DLPH	$e^+e^- \rightarrow Z$

¹⁰⁹ ADAM 96D assumes $f_{B^0} = f_{B^-} = 0.39$ and $f_{B_s} = 0.12$.

POLARIZATION IN B_s^0 DECAY Γ_L/Γ in $B_s^0 \rightarrow J/\psi(1S)\phi$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.541±0.017 OUR AVERAGE				
0.555±0.027±0.006	¹¹⁰	ABAZOV	09E D0	$p\bar{p}$ at 1.96 TeV
0.531±0.020±0.007	¹¹¹	AALTONEN	08J CDF	$p\bar{p}$ at 1.96 TeV
0.61 ±0.14 ±0.02	¹¹²	AFFOLDER	00N CDF	$p\bar{p}$ at 1.8 TeV
0.56 ±0.21 $^{+0.02}_{-0.04}$	19	ABE	95Z CDF	$p\bar{p}$ at 1.8 TeV

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

0.62 ±0.06 ±0.01 ACOSTA 05 CDF Repl. by AALTONEN 08J

¹¹⁰ Measured the angular and lifetime parameters for the time-dependent angular untagged decays $B_d^0 \rightarrow J/\psi K^{*0}$ and $B_s^0 \rightarrow J/\psi\phi$.¹¹¹ Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.¹¹² AFFOLDER 00N measurements are based on 40 B_s^0 candidates obtained from a data sample of 89 pb⁻¹. The P -wave fraction is found to be $0.23 \pm 0.19 \pm 0.04$. Γ_{\perp}/Γ in $B_s^0 \rightarrow J/\psi(1S)\phi$

VALUE	DOCUMENT ID	TECN	COMMENT
0.241±0.023 OUR AVERAGE			
0.244±0.032±0.014	¹¹³ ABAZOV	09E D0	$p\bar{p}$ at 1.96 TeV
0.239±0.029±0.011	¹¹⁴ AALTONEN	08J CDF	$p\bar{p}$ at 1.96 TeV

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

0.125±0.069±0.002 ACOSTA 05 CDF Repl. by AALTONEN 08J

¹¹³ Measured the angular and lifetime parameters for the time-dependent angular untagged decays $B_d^0 \rightarrow J/\psi K^{*0}$ and $B_s^0 \rightarrow J/\psi\phi$.¹¹⁴ Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays. ϕ_{\parallel} in $B_s^0 \rightarrow J/\psi(1S)\phi$

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
$2.72^{+1.12}_{-0.27} \pm 0.26$	ABAZOV	09E D0	$p\bar{p}$ at 1.96 TeV

$B_s^0\text{-}\bar{B}_s^0$ MIXING

For a discussion of $B_s^0\text{-}\bar{B}_s^0$ mixing see the note on “ $B^0\text{-}\bar{B}^0$ Mixing” in the B^0 Particle Listings above.

χ_s is a measure of the time-integrated $B_s^0\text{-}\bar{B}_s^0$ mixing probability that produced $B_s^0(\bar{B}_s^0)$ decays as a $\bar{B}_s^0(B_s^0)$. Mixing violates $\Delta B \neq 2$ rule.

$$\chi_s = \frac{x_s^2}{2(1+x_s^2)}$$

$$x_s = \frac{\Delta m_{B_s^0}}{\Gamma_{B_s^0}} = (m_{B_{sH}^0} - m_{B_{sL}^0}) \tau_{B_s^0},$$

where H, L stand for heavy and light states of two B_s^0 CP eigenstates and

$$\tau_{B_s^0} = \frac{1}{0.5(\Gamma_{B_{sH}^0} + \Gamma_{B_{sL}^0})}.$$

$$\Delta m_{B_s^0} = m_{B_{sH}^0} - m_{B_{sL}^0}$$

$\Delta m_{B_s^0}$ is a measure of 2π times the $B_s^0\text{-}\bar{B}_s^0$ oscillation frequency in time-dependent mixing experiments.

VALUE ($10^{12} \hbar s^{-1}$)	CL%	DOCUMENT ID	TECN	COMMENT
$17.77 \pm 0.10 \pm 0.07$		115 ABULENCIA,A 06G	CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
17–21	90	116 ABAZOV	06B D0	$p\bar{p}$ at 1.96 TeV
$17.31^{+0.33}_{-0.18} \pm 0.07$		117 ABULENCIA	06Q CDF	Repl. by ABULENCIA,A 06G
> 8.0	95	118 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 4.9	95	119 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 8.5	95	120 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 5.0	95	121 ABDALLAH	03B DLPH	$e^+e^- \rightarrow Z$
>10.3	95	122 ABE	03 SLD	$e^+e^- \rightarrow Z$
>10.9	95	123 HEISTER	03E ALEP	$e^+e^- \rightarrow Z$
> 5.3	95	124 ABE	02V SLD	$e^+e^- \rightarrow Z$
> 1.0	95	125 ABBIENDI	01D OPAL	$e^+e^- \rightarrow Z$
> 7.4	95	126 ABREU	00Y DLPH	Repl. by ABDALLAH 04J
> 4.0	95	127 ABREU,P	00G DLPH	$e^+e^- \rightarrow Z$
> 5.2	95	128 ABBIENDI	99S OPAL	$e^+e^- \rightarrow Z$
<96	95	129 ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
> 5.8	95	130 ABE	99J CDF	$p\bar{p}$ at 1.8 TeV
> 9.6	95	131 BARATE	99J ALEP	$e^+e^- \rightarrow Z$
> 7.9	95	132 BARATE	98C ALEP	Repl. by BARATE 99J
> 3.1	95	133 ACKERSTAFF	97U OPAL	Repl. by ABBIENDI 99S
> 2.2	95	134 ACKERSTAFF	97V OPAL	Repl. by ABBIENDI 99S
> 6.5	95	135 ADAM	97 DLPH	Repl. by ABREU 00Y
> 6.6	95	136 BUSKULIC	96M ALEP	Repl. by BARATE 98C
> 2.2	95	134 AKERS	95J OPAL	Sup. by ACKERSTAFF 97V
> 5.7	95	137 BUSKULIC	95J ALEP	$e^+e^- \rightarrow Z$
> 1.8	95	134 BUSKULIC	94B ALEP	$e^+e^- \rightarrow Z$

- 115 Significance of oscillation signal is 5.4σ . Also reports $|V_{td} / V_{ts}| = 0.2060 \pm 0.0007^{+0.0081}_{-0.0060}$.
- 116 A likelihood scan over the oscillation frequency, Δm_s , gives a most probable value of 19 ps^{-1} and a range of $17 < \Delta m_s < 21 \text{ (ps}^{-1})$ at 90% C.L. assuming Gaussian uncertainties. Also excludes $\Delta m_s < 14.8 \text{ ps}^{-1}$ at 95% C.L.
- 117 Significance of oscillation signal is 0.2%. Also reported the value $|V_{td} / V_{ts}| = 0.208^{+0.001+0.008}_{-0.002-0.006}$.
- 118 Uses leptons emitted with large momentum transverse to a jet and improved techniques for vertexing and flavor-tagging.
- 119 Updates of D_s -lepton analysis.
- 120 Combined results from all Delphi analyses.
- 121 Events with a high transverse momentum lepton were removed and an inclusively reconstructed vertex was required.
- 122 ABE 03 uses the novel "charge dipole" technique to reconstruct separate secondary and tertiary vertices originating from the $B \rightarrow D$ decay chain. The analysis excludes $\Delta m_s < 4.9 \text{ ps}^{-1}$ and $7.9 < \Delta m_s < 10.3 \text{ ps}^{-1}$.
- 123 Three analyses based on complementary event selections: (1) fully-reconstructed hadronic decays; (2) semileptonic decays with D_s exclusively reconstructed; (3) inclusive semileptonic decays.
- 124 ABE 02V uses exclusively reconstructed D_s^- mesons and excludes $\Delta m_s < 1.4 \text{ ps}^{-1}$ and $2.4 < \Delta m_s < 5.3 \text{ ps}^{-1}$ at 95%CL.
- 125 Uses fully or partially reconstructed $D_s \ell$ vertices and a mixing tag as a flavor tagging.
- 126 Replaced by ABDALLAH 04A. Uses $D_s^- \ell^+$, and $\phi \ell^+$ vertices, and a multi-variable discriminant as a flavor tagging.
- 127 Uses inclusive D_s vertices and fully reconstructed B_s decays and a multi-variable discriminant as a flavor tagging.
- 128 Uses ℓ - Q_{hem} and ℓ - ℓ .
- 129 ABE 99D assumes $\tau_{B_s^0} = 1.55 \pm 0.05 \text{ ps}$ and $\Delta\Gamma/\Delta m = (5.6 \pm 2.6) \times 10^{-3}$.
- 130 ABE 99J uses ϕ ℓ - ℓ correlation.
- 131 BARATE 99J uses combination of an inclusive lepton and D_s^- -based analyses.
- 132 BARATE 98C combines results from $D_s h\text{-}\ell/Q_{\text{hem}}$, $D_s h\text{-}K$ in the same side, $D_s \ell\text{-}\ell/Q_{\text{hem}}$ and $D_s \ell\text{-}K$ in the same side.
- 133 Uses ℓ - Q_{hem} .
- 134 Uses ℓ - ℓ .
- 135 ADAM 97 combines results from $D_s \ell\text{-}Q_{\text{hem}}$, $\ell\text{-}Q_{\text{hem}}$, and $\ell\text{-}\ell$.
- 136 BUSKULIC 96M uses D_s lepton correlations and lepton, kaon, and jet charge tags.
- 137 BUSKULIC 95J uses ℓ - Q_{hem} . They find $\Delta m_s > 5.6$ [> 6.1] for $f_s=10\%$ [12%]. We interpolate to our central value $f_s=10.5\%$.

$$x_s = \Delta m_{B_s^0} / \Gamma_{B_s^0}$$

This is derived by the Heavy Flavor Averaging Group (HFAG) from the results on $\Delta m_{B_s^0}$ and "OUR EVALUATION" of the B_s^0 mean lifetime.

VALUE

DOCUMENT ID

26.2±0.5 OUR EVALUATION

χ_s

This is a $B_s^0\text{-}\bar{B}_s^0$ integrated mixing parameter derived from χ_s above and OUR EVALUATION of $\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$.

VALUEDOCUMENT ID**0.49927 \pm 0.00003 OUR EVALUATION****CP VIOLATION PARAMETERS in B_s^0** **$\text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2)$**

CP impurity in B_s^0 system.

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

VALUE (units 10^{-3})DOCUMENT IDTECNCOMMENT**−0.9 \pm 2.6 OUR EVALUATION****6.1 \pm 4.8 \pm 0.9**138 ABAZOV 07A D0 $p\bar{p}$ at 1.96 TeV

138 The first direct measurement of the time integrated flavor untagged charge asymmetry in semileptonic B_s^0 decays is reported as $2xA_{SL}^s(\text{untagged}) = A_{SL}^s = (2.45 \pm 1.93 \pm 0.35) \times 10^{-2}$.

CP Violation phase β_s

$-2\beta_s$ is the weak phase difference between B_s^0 mixing amplitude and the $B_s^0 \rightarrow J/\psi\phi$ decay amplitude. The Standard Model value of β_s is $\arg(-\frac{V_{ts}V_{tb}^*}{V_{cs}V_{cb}^*})$.

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

VALUEDOCUMENT IDTECNCOMMENT**0.47 $\frac{+0.13}{-0.21}$ or 1.09 $\frac{+0.21}{-0.13}$ OUR EVALUATION**139 AALTONEN 08G CDF $p\bar{p}$ at 1.96 GeV**0.28 $\frac{+0.12}{-0.15}$ $\frac{+0.04}{-0.01}$** 140,141 ABAZOV 08AMD0 $p\bar{p}$ at 1.96 TeV

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

0.395 \pm 0.280 $\frac{+0.005}{-0.070}$ 142,143 ABAZOV 07 D0 Repl. by ABAZOV 07N

0.35 $\frac{+0.20}{-0.24}$ 143,144 ABAZOV 07N D0 Repl. by ABAZOV 08AM

- 139 Reports $0.32 < 2\beta_s < 2.82$ at 68% C.L. and confidence regions in the two-dimensional space of $2\beta_s$ and $\Delta\Gamma$ from the first measurement of $B_s^0 \rightarrow J/\psi\phi$ decays using flavor tagging. The probability of a deviation from SM prediction as large as the level of observed data is 15%.
- 140 Measured using fully reconstructed $B_s \rightarrow J/\psi\phi$ decays.
- 141 Reports $\phi_s = -2\beta_s$ and obtains 90% CL interval $-0.03 < \beta_s < 0.60$.
- 142 The first direct measurement of the CP -violating mixing phase is reported from the time-dependent analysis of flavor untagged $B_s^0 \rightarrow J/\psi\phi$ decays.
- 143 Reports ϕ_s which equals to $-2\beta_s$.
- 144 Combines D0 collaboration measurements of time-dependent angular distributions in $B_s^0 \rightarrow J/\psi\phi$ and charge asymmetry in semileptonic decays. There is a 4-fold ambiguity in the solution.

B_s^0 REFERENCES

AALTONEN	09AQ	PRL 103 191802	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	09B	PR D79 011104R	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	09C	PRL 103 031801	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	09P	PRL 102 201801	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	09E	PRL 102 032001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	09G	PRL 102 051801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	09I	PRL 102 091801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	09Y	PR D79 111102R	V.M. Abazov <i>et al.</i>	(D0 Collab.)
LOUVOT	09	PRL 102 021801	R. Louvot <i>et al.</i>	(BELLE Collab.)
AALTONEN	08F	PRL 100 021803	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	08G	PRL 100 161802	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	08I	PRL 100 101802	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	08J	PRL 100 121803	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	08AM	PRL 101 241801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
WICHT	08A	PRL 100 121801	J. Wicht <i>et al.</i>	(BELLE Collab.)
ABAZOV	07	PRL 98 121801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	07A	PRL 98 151801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	07N	PR D76 057101	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	07Q	PR D76 092001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	07Y	PRL 99 241801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABULENCIA	07C	PRL 98 061802	A. Abulencia <i>et al.</i>	(FNAL CDF Collab.)
DRUTSKOY	07	PRL 98 052001	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07A	PR D76 012002	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
ABAZOV	06B	PRL 97 021802	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	06G	PR D74 031107R	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	06V	PRL 97 241801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABULENCIA	06J	PRL 96 191801	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABULENCIA	06N	PRL 96 231801	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABULENCIA	06Q	PRL 97 062003	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABULENCIA,A	06D	PRL 97 211802	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABULENCIA,A	06G	PRL 97 242003	A. Abulencia <i>et al.</i>	(CDF Collab.)
ACOSTA	06	PRL 96 202001	D. Acosta <i>et al.</i>	(CDF Collab.)
ABAZOV	05B	PRL 94 042001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	05E	PRL 94 071802	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	05W	PRL 95 171801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABULENCIA	05	PRL 95 221805	A. Abulencia <i>et al.</i>	(CDF Collab.)
Also		PRL 95 249905 (erratum)	A. Abulencia <i>et al.</i>	(CDF Collab.)
ACOSTA	05	PRL 94 101803	D. Acosta <i>et al.</i>	(CDF Collab.)
ACOSTA	05J	PRL 95 031801	D. Acosta <i>et al.</i>	(CDF Collab.)
ABDALLAH	04A	PL B585 63	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
ABDALLAH	04J	EPJ C35 35	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
ACOSTA	04D	PRL 93 032001	D. Acosta <i>et al.</i>	(CDF Collab.)
ABDALLAH	03B	EPJ C28 155	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
ABE	03	PR D67 012006	K. Abe <i>et al.</i>	(SLD Collab.)
HEISTER	03E	EPJ C29 143	A. Heister <i>et al.</i>	(ALEPH Collab.)
ABE	02V	PR D66 032009	K. Abe <i>et al.</i>	(SLD Collab.)
ACOSTA	02D	PR D65 111101R	D. Acosta <i>et al.</i>	(CDF Collab.)
ACOSTA	02G	PR D66 112002	D. Acosta <i>et al.</i>	(CDF Collab.)
ABBIENDI	01D	EPJ C19 241	G. Abbiendi <i>et al.</i>	(OPAL Collab.)

ABE	00C	PR D62 071101R	K. Abe <i>et al.</i>	(SLD Collab.)
ABREU	00Y	EPJ C16 555	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ABREU,P	00G	EPJ C18 229	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AFFOLDER	00N	PRL 85 4668	T. Affolder <i>et al.</i>	(CDF Collab.)
BARATE	00K	PL B486 286	R. Barate <i>et al.</i>	(ALEPH Collab.)
ABBIENDI	99S	EPJ C11 587	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
ABE	99D	PR D59 032004	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	99J	PRL 82 3576	F. Abe <i>et al.</i>	(CDF Collab.)
BARATE	99J	EPJ C7 553	R. Barate <i>et al.</i>	(ALEPH Collab.)
Also		EPJ C12 181 (erratum)	R. Barate <i>et al.</i>	(ALEPH Collab.)
ABE	98	PR D57 R3811	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	98B	PR D57 5382	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	98V	PRL 81 5742	F. Abe <i>et al.</i>	(CDF Collab.)
ACCIARRI	98S	PL B438 417	M. Acciarri <i>et al.</i>	(L3 Collab.)
ACKERSTAFF	98F	EPJ C2 407	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ACKERSTAFF	98G	PL B426 161	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
BARATE	98C	EPJ C4 367	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARATE	98Q	EPJ C4 387	R. Barate <i>et al.</i>	(ALEPH Collab.)
PDG	98	EPJ C3 1	C. Caso <i>et al.</i>	
ACCIARRI	97B	PL B391 474	M. Acciarri <i>et al.</i>	(L3 Collab.)
ACCIARRI	97C	PL B391 481	M. Acciarri <i>et al.</i>	(L3 Collab.)
ACKERSTAFF	97U	ZPHY C76 401	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ACKERSTAFF	97V	ZPHY C76 417	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ADAM	97	PL B414 382	W. Adam <i>et al.</i>	(DELPHI Collab.)
ABE	96B	PR D53 3496	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	96L	PRL 76 4675	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	96N	PRL 77 1945	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	96Q	PR D54 6596	F. Abe <i>et al.</i>	(CDF Collab.)
ABREU	96F	ZPHY C71 11	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ADAM	96D	ZPHY C72 207	W. Adam <i>et al.</i>	(DELPHI Collab.)
BUSKULIC	96E	ZPHY C69 585	D. Buskalic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	96M	PL B377 205	D. Buskalic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	96V	PL B384 471	D. Buskalic <i>et al.</i>	(ALEPH Collab.)
PDG	96	PR D54 1	R. M. Barnett <i>et al.</i>	
ABE	95R	PRL 74 4988	F. Abe <i>et al.</i>	(CDF Collab.)
ABE	95Z	PRL 75 3068	F. Abe <i>et al.</i>	(CDF Collab.)
ACCIARRI	95H	PL B363 127	M. Acciarri <i>et al.</i>	(L3 Collab.)
ACCIARRI	95I	PL B363 137	M. Acciarri <i>et al.</i>	(L3 Collab.)
AKERS	95G	PL B350 273	R. Akers <i>et al.</i>	(OPAL Collab.)
AKERS	95J	ZPHY C66 555	R. Akers <i>et al.</i>	(OPAL Collab.)
BUSKULIC	95J	PL B356 409	D. Buskalic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	95O	PL B361 221	D. Buskalic <i>et al.</i>	(ALEPH Collab.)
ABREU	94D	PL B324 500	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ABREU	94E	ZPHY C61 407	P. Abreu <i>et al.</i>	(DELPHI Collab.)
Also		PL B289 199	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AKERS	94J	PL B337 196	R. Akers <i>et al.</i>	(OPAL Collab.)
AKERS	94L	PL B337 393	R. Akers <i>et al.</i>	(OPAL Collab.)
BUSKULIC	94B	PL B322 441	D. Buskalic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	94C	PL B322 275	D. Buskalic <i>et al.</i>	(ALEPH Collab.)
ABE	93F	PRL 71 1685	F. Abe <i>et al.</i>	(CDF Collab.)
ACTON	93H	PL B312 501	P.D. Acton <i>et al.</i>	(OPAL Collab.)
BUSKULIC	93G	PL B311 425	D. Buskalic <i>et al.</i>	(ALEPH Collab.)
ABREU	92M	PL B289 199	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ACTON	92N	PL B295 357	P.D. Acton <i>et al.</i>	(OPAL Collab.)
BUSKULIC	92E	PL B294 145	D. Buskalic <i>et al.</i>	(ALEPH Collab.)
LEE-FRANZINI	90	PRL 65 2947	J. Lee-Franzini <i>et al.</i>	(CUSB II Collab.)