B_s^0

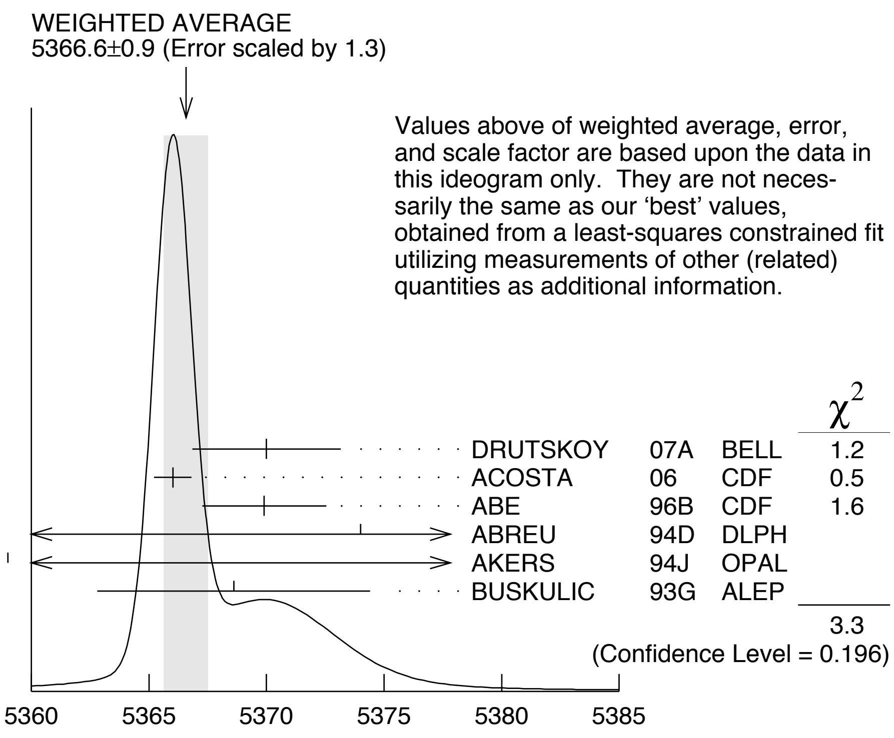
$I(J^P) = 0(0^-)$

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					
5366.6 ± 0.9 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.					
5370 ± 1 ±3		DRUTSKOY	07A	BELL	$e^+e^- \rightarrow \Upsilon(5S)$
5366.01 ± 0.73 ± 0.33		[1] ACOSTA	06	CDF	$p\overline{p}$ at 1.96 TeV
5369.9 ± 2.3 ± 1.3	32	[2] ABE	96B	CDF	$p\overline{p}$ 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 ±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 $B_s \rightarrow D_s^- \pi^+$.



B_s^0 mass (MeV)

$m_{B^0_s} - m_B$

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	$p\overline{p}$ at 1.96 TeV
89.7 ±2.7 ±1.2		ABE	96B	CDF	$p\overline{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
80 to 130	68	LEE-FRANZINI	90	CSB2	$e^+e^- \rightarrow \Upsilon(5S)$

[4] The reported result is $m_{B^0_s} - m_{B^0} = 86.38 \pm 0.90 \pm 0.06$ MeV. We convert it to the mass difference with respect to the average of $(m_{B^\pm} + m_{B^0})/2$.

$m_{B^0_{sH}} - m_{B^0_{sL}}$

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

B^0_s 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 $1 / [0.5\ (\Gamma_{B^0_{sL}} + \Gamma_{B^0_{sH}})]$. 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
$1.470^{+0.026}_{-0.027}$ OUR EVALUATION First					
1.425±0.041 OUR EVALUATION Second					
$1.398 \pm 0.044 ^{+0.028}_{-0.025}$		[5] ABAZOV	06V	D0	$p\overline{p}$ at 1.96 TeV
$1.42\ ^{+0.14}_{-0.13} \pm 0.03$		[6] ABREU	00Y	DLPH	$e^+e^- \rightarrow Z$
$1.53\ ^{+0.16}_{-0.15} \pm 0.07$		[7] ABREU,P	00G	DLPH	$e^+e^- \rightarrow Z$
$1.36 \pm 0.09\ ^{+0.06}_{-0.05}$		[8] ABE	99D	CDF	$p\overline{p}$ at 1.8 TeV
$1.72\ ^{+0.20}_{-0.19}\ ^{+0.18}_{-0.17}$		[9] ACKERSTAFF	98F	OPAL	$e^+e^- \rightarrow Z$
$1.50\ ^{+0.16}_{-0.15} \pm 0.04$		[8] ACKERSTAFF	98G	OPAL	$e^+e^- \rightarrow Z$
$1.47 \pm 0.14 \pm 0.08$		[7] BARATE	98C	ALEP	$e^+e^- \rightarrow Z$
$1.54\ ^{+0.14}_{-0.13} \pm 0.04$		[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	$e^+e^- \to Z$
1.56	$^{+0.29}_{-0.26}$	$^{+0.08}_{-0.07}$		[8] ABREU	96F	DLPH	Repl. by ABREU 00Y
1.65	$^{+0.34}_{-0.31}$	± 0.12		[7] ABREU	96F	DLPH	Repl. by ABREU 00Y
1.76	± 0.20	$^{+0.15}_{-0.10}$		[11] ABREU	96F	DLPH	Repl. by ABREU 00Y
1.60	± 0.26	$^{+0.13}_{-0.15}$		[12] ABREU	96F	DLPH	Repl. by ABREU,P 00G
1.67	± 0.14			[13] ABREU	96F	DLPH	$e^+e^- \to Z$
1.61	$^{+0.30}_{-0.29}$	$^{+0.18}_{-0.16}$	90	[7] BUSKULIC	96E	ALEP	Repl. by BARATE 98C
1.42	$^{+0.27}_{-0.23}$	± 0.11	76	[8] ABE	95R	CDF	Repl. by ABE 99D
1.74	$^{+1.08}_{-0.69}$	± 0.07	8	[14] ABE	95R	CDF	Sup. by ABE 96N
1.54	$^{+0.25}_{-0.21}$	± 0.06	79	[8] AKERS	95G	OPAL	Repl. by ACKERSTAFF 98G
1.59	$^{+0.17}_{-0.15}$	± 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	$^{+0.45}_{-0.35}$	± 0.04	31	[8] BUSKULIC	94C	ALEP	Sup. by BUSKULIC 95O
1.13	$^{+0.35}_{-0.26}$	± 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 $D_s^- \to \phi\pi^-$ and $D_s^- \to K^{*0}K^-$ 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 $B_s \to \psi\phi$.
[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±0.042 OUR EVALUATION						
1.41 ±0.04 OUR AVERAGE						
1.398	± 0.044	$^{+0.028}_{-0.025}$	[16] ABAZOV	06V	D0	$p\overline{p}$ at 1.96 TeV
1.42	$^{+0.14}_{-0.13}$	± 0.03	[17] ABREU	00Y	DLPH	$e^+e^- \to Z$
1.36	± 0.09	$^{+0.06}_{-0.05}$	[18] ABE	99D	CDF	$p\overline{p}$ at 1.8 TeV
1.50	$^{+0.16}_{-0.15}$	± 0.04	[19] ACKERSTAFF	98G	OPAL	$e^+e^- \to Z$
1.54	$^{+0.14}_{-0.13}$	± 0.04	[18] BUSKULIC	96M	ALEP	$e^+e^- \to Z$

[16] Measured using $D_s^- \mu^+$ vertices.

[17] Uses $D_s^- \ell^+$, and $\phi\ell^+$ vertices.

[18] Measured using $D_s^- \ell^+$ vertices.

[19] ACKERSTAFF 98F use fully reconstructed $D_s^- \rightarrow \phi\pi^-$ and $D_s^- \rightarrow K^{*0} K^-$ in the inclusive B_s^0 decay.

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				
1.43 ±0.09 OUR AVERAGE				
$1.444^{+0.098}_{-0.090}\pm0.020$	[20] ABAZOV	05B	D0	$p\overline{p}$ at 1.96 TeV
$1.34\ ^{+0.23}_{-0.19}\ \pm0.05$	[20] ABE	98B	CDF	$p\overline{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.39\ ^{+0.13}_{-0.16}\ ^{+0.01}_{-0.02}$	[21] ABAZOV	05W	D0	$p\overline{p}$ at 1.96 TeV
$1.40\ ^{+0.15}_{-0.13}\ \pm0.02$	[21] ACOSTA	05	CDF	Repl. by AALTONEN 2008J
$1.34\ ^{+0.23}_{-0.19}\ \pm0.05$	[22] ABE	96N	CDF	Repl. by ABE 98B

[20] Measured using fully reconstructed $B_s \rightarrow J/\psi(1S)\phi$ decay.

[21] Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.

[22] 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*
0.91 ±0.09 ±0.003	[23] ABAZOV	05W	D0	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.980^{+0.076}_{-0.071}\pm0.003$	[24] ABAZOV	05B	D0	Repl. by ABAZOV 05W

[23] Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.

[24] Measured mean life ratio using fully reconstructed decays.

B_{sH}^0 MEAN LIFE

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

"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.

VALUE (10^{-12} s)	*DOCUMENT ID*	*TECN*	*COMMENT*
$\mathbf{1.525^{+0.062}_{-0.063}}$ **OUR EVALUATION**			
$\mathbf{1.44 \pm 0.05}$ **OUR AVERAGE**			
$1.437^{+0.054}_{-0.047}$	[25,26] AALTONEN 08J	CDF	$p\overline{p}$ at 1.96 TeV
$1.58\ ^{+0.39}_{-0.42}\ ^{+0.01}_{-0.02}$	[26] ABAZOV 05W	D0	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2.07\ ^{+0.58}_{-0.46}\ \pm 0.03$	[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 $B^0_s \rightarrow J/\psi\phi$ decays.

B^0_{sL} MEAN LIFE

B^0_{sL} is the light state of two B^0_s *CP* eigenstates.

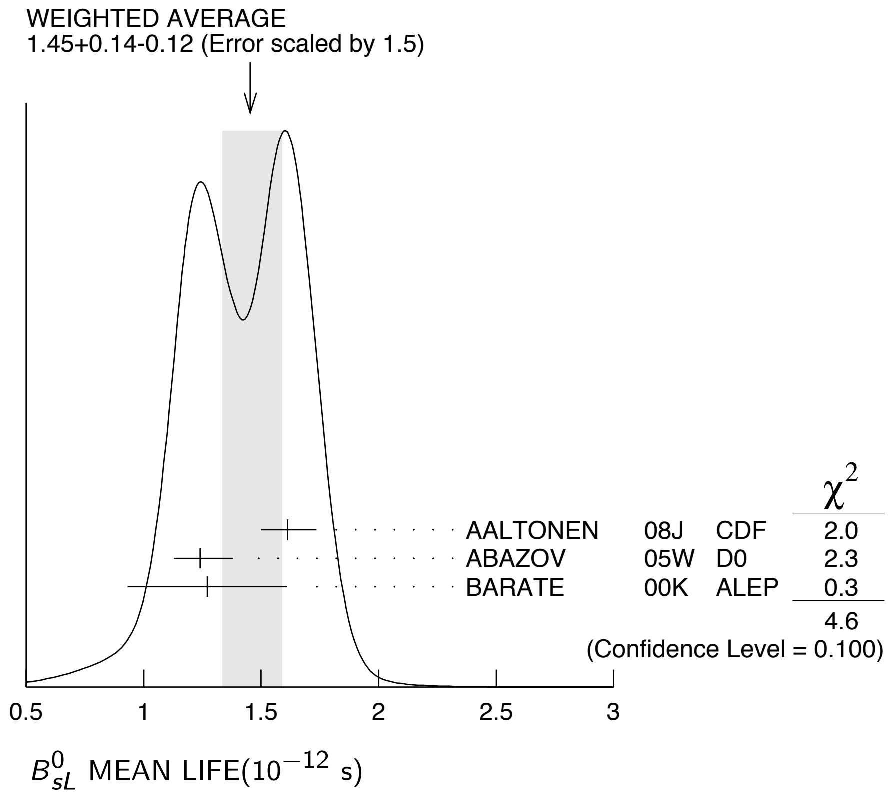
"OUR EVALUATION" is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at http://www.slac.stanford.edu/xorg/hfag/. The averaging/rescaling procedure takes into account correlations between the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

VALUE (10^{-12} s)	*DOCUMENT ID*	*TECN*	*COMMENT*
$\mathbf{1.419^{+0.039}_{-0.038}}$ **OUR EVALUATION**			
$\mathbf{1.45\ ^{+0.14}_{-0.12}}$ **OUR AVERAGE** Error includes scale factor of 1.5. See the ideogram below.			
$1.613^{+0.123}_{-0.113}$	[27,28] AALTONEN 08J	CDF	$p\overline{p}$ at 1.96 TeV
$1.24\ ^{+0.14}_{-0.11}\ ^{+0.01}_{-0.02}$	[28] ABAZOV 05W	D0	$p\overline{p}$ at 1.96 TeV
$1.27\ \pm 0.33\ \pm 0.08$	[29] BARATE 00K	ALEP	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.05\ ^{+0.16}_{-0.13}\ \pm 0.02$	[28] ACOSTA 05	CDF	Repl. by AALTONEN 08J

[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 $B^0_s \rightarrow J/\psi\phi$ decays.

[29] Uses $\phi\phi$ correlations from $B^0_s \rightarrow D_s^{(*)+} D_s^{(*)-}$.



$\Delta\Gamma_{B^0_s}/\Gamma_{B^0_s}$

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

"OUR EVALUATION" is an average of all available B_s semi-leptonic lifetime measurements with the $\Delta\Gamma_{B^0_s}/\Gamma_s$ analyses performed by the Heavy Flavor Averaging Group (HFAG) as described in our "Review on B-$\overline{B}$ Mixing" in the B^0 Section of these Listings. The corresponding 95% CL is $-0.052 < \Delta\Gamma_{B^0_s}/\Gamma_{B^0_s} < 0.18$.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$0.069^{+0.058}_{-0.062}$ OUR EVALUATION					
$0.116^{+0.09}_{-0.10}\pm0.010$		[30] AALTONEN	08J	CDF	$p\overline{p}$ at 1.96 TeV
$0.24\ ^{+0.28}_{-0.38}\ ^{+0.03}_{-0.04}$		[30,31] ABAZOV	05W	D0	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.65\ ^{+0.25}_{-0.33}\pm0.01$		[30] ACOSTA	05	CDF	Repl. by AALTONEN 08J
<0.46	95	[32] ABREU	00Y	DLPH	$e^+e^- \to Z$
<0.69	95	[33] ABREU,P	00G	DLPH	$e^+e^- \to Z$
<0.83	95	[34] ABE	99D	CDF	$p\overline{p}$ at 1.8 TeV
<0.67	95	[35] ACCIARRI	98S	L3	$e^+e^- \to Z$

[30] Measured using the time-dependent angular analysis of $B_s^0 \to J/\psi\phi$ decays.
[31] Uses $|A_0|^2 - |A_{||}|^2$=0.355 ± 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" 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.

VALUE (10^{12} s^{-1})	*DOCUMENT ID*		*TECN*	*COMMENT*
$0.049^{+0.040}_{-0.043}$ OUR EVALUATION				
0.09 ±0.05 OUR AVERAGE				
$0.076^{+0.059}_{-0.063} \pm 0.006$	[36] AALTONEN	08J	CDF	$p\overline{p}$ at 1.96 TeV
0.13 ± 0.09	[37] ABAZOV	07N	D0	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.12\ ^{+0.08}_{-0.10} \pm 0.02$	[36,38] ABAZOV	07	D0	Repl. by ABAZOV 07N
$0.47\ ^{+0.19}_{-0.24} \pm 0.01$	[36] ACOSTA	05	CDF	Repl. by AALTONEN 08J

[36] Measured using the time-dependent angular analysis of $B_s^0 \to J/\psi\phi$ decays and assuming *CP*-violating phase $\phi_s = 0$.
[37] Combines D^0 measurements of time-dependent angular distributions in $B_s^0 \to J/\psi\phi$ and charge asymmetry in semileptonic decays. There is a 4-fold ambiguity in the solution.
[38] ABAZOV 07 reports $0.17 \pm 0.09 \pm 0.02$ with *CP*-violating phase ϕ_s as a free parameter.

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

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*
0.10 ±0.05 OUR AVERAGE		Error includes scale factor of 1.2.			
$0.079^{+0.038}_{-0.035}{}^{+0.031}_{-0.030}$		[39] ABAZOV	07Y	D0	$p\overline{p}$ at 1.96 TeV
$0.25\ ^{+0.21}_{-0.14}$		[40] BARATE	00K	ALEP	$e^+e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>0.012	95	[39] AALTONEN	08F	CDF	$p\overline{p}$ at 1.96 TeV

[39] Assumes 2 B($B_s^0 \to D_s^{(*)} D_s^{(*)}$) $\simeq \Delta\Gamma_s^{CP} / \Gamma_s$.
[40] Uses $\phi\phi$ correlations from $B_s^0 \to D_s^{(*)+} D_s^{(*)-}$.

$1 / \Gamma_{B^0_s}$

"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.

VALUE (10^{-12} s)	*DOCUMENT ID*		*TECN*	*COMMENT*
$1.47^{+0.026}_{-0.027}$ OUR EVALUATION				
1.52±0.04 ±0.02	[41] AALTONEN	08J	CDF	$p\overline{p}$ at 1.96 TeV

[41] Measured using the time-dependent angular analysis of $B^0_s \rightarrow J/\psi\phi$ decays.

B^0_s DECAY MODES

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

The branching fraction B($B^0_s \rightarrow D^-_s \ell^+ \nu_\ell$ anything) is not a pure measurement since the measured product branching fraction B($\overline{b} \rightarrow B^0_s$) × B($B^0_s \rightarrow D^-_s \ell^+ \nu_\ell$ anything) was used to determine B($\overline{b} \rightarrow B^0_s$), as described in the note on "B^0-$\overline{B}^0$ Mixing"

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

	Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	D^-_s anything		(93 ±25) %	
Γ_2	$D^-_s \ell^+ \nu_\ell$ anything	[a]	(7.9 ± 2.4) %	
Γ_3	$D^-_s \pi^+$		(3.2 ± 0.9) × 10^{-3}	S=1.3
Γ_4	$D^-_s \pi^+ \pi^+ \pi^-$		(8.4 ± 3.3) × 10^{-3}	
Γ_5	$D_s^{(*)+} D_s^{(*)-}$		($4.9^{+2.9}_{-2.5}$) %	S=1.2
Γ_6	$D^+_s D^-_s$		(1.1 ± 0.4) %	
Γ_7	$D^{*+}_s D^-_s$		< 12.1 %	CL=90%
Γ_8	$D^{*+}_s D^{*-}_s$		< 25.7 %	CL=90%
Γ_9	$J/\psi(1S)\phi$		(9.3 ± 3.3) × 10^{-4}	
Γ_{10}	$J/\psi(1S)\pi^0$		< 1.2 × 10^{-3}	CL=90%
Γ_{11}	$J/\psi(1S)\eta$		< 3.8 × 10^{-3}	CL=90%
Γ_{12}	$\psi(2S)\phi$		(4.8 ± 2.2) × 10^{-4}	
Γ_{13}	$\pi^+\pi^-$		< 1.7 × 10^{-6}	CL=90%

Γ_{14}	$\pi^0\pi^0$			$<$ 2.1	$\times 10^{-4}$	CL=90%
Γ_{15}	$\eta\pi^0$			$<$ 1.0	$\times 10^{-3}$	CL=90%
Γ_{16}	$\eta\eta$			$<$ 1.5	$\times 10^{-3}$	CL=90%
Γ_{17}	$\rho^0\rho^0$			$<$ 3.20	$\times 10^{-4}$	CL=90%
Γ_{18}	$\phi\rho^0$			$<$ 6.17	$\times 10^{-4}$	CL=90%
Γ_{19}	$\phi\phi$			(1.4 $\pm$ 0.8)	$\times 10^{-5}$	
Γ_{20}	π^+K^-			$<$ 5.6	$\times 10^{-6}$	CL=90%
Γ_{21}	K^+K^-			(3.3 $\pm$ 0.9)	$\times 10^{-5}$	
Γ_{22}	$\overline{K}^*(892)^0\rho^0$			$<$ 7.67	$\times 10^{-4}$	CL=90%
Γ_{23}	$\overline{K}^*(892)^0 K^*(892)^0$			$<$ 1.681	$\times 10^{-3}$	CL=90%
Γ_{24}	$\phi K^*(892)^0$			$<$ 1.013	$\times 10^{-3}$	CL=90%
Γ_{25}	$p\overline{p}$			$<$ 5.9	$\times 10^{-5}$	CL=90%
Γ_{26}	$\gamma\gamma$	B1		$<$ 5.3	$\times 10^{-5}$	CL=90%
Γ_{27}	$\phi\gamma$			$<$ 1.2	$\times 10^{-4}$	CL=90%

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

Γ_{28}	$\mu^+\mu^-$	B1		$<$ 4.7	$\times 10^{-8}$	CL=90%
Γ_{29}	e^+e^-	B1		$<$ 5.4	$\times 10^{-5}$	CL=90%
Γ_{30}	$e^\pm\mu^\mp$	LF	[b]	$<$ 6.1	$\times 10^{-6}$	CL=90%
Γ_{31}	$\phi(1020)\mu^+\mu^-$	B1		$<$ 3.2	$\times 10^{-6}$	CL=90%
Γ_{32}	$\phi\nu\overline{\nu}$	B1		$<$ 5.4	$\times 10^{-3}$	CL=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

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.93±0.25 OUR AVERAGE					
0.91±0.18±0.41		[42] DRUTSKOY	07	BELL	$e^+e^- \rightarrow \Upsilon(4S)$
0.81±0.24±0.22	90	[43] BUSKULIC	96E	ALEP	$e^+e^- \rightarrow Z$
1.56±0.58±0.44	147	[44] ACTON	92N	OPAL	$e^+e^- \rightarrow Z$

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

[43] BUSKULIC 96E separate $c\overline{c}$ and $b\overline{b}$ sources of D_s^+ mesons using a lifetime tag, subtract generic $\overline{b} \rightarrow W^+ \rightarrow D_s^+$ events, and obtain B($\overline{b} \rightarrow B_s^0$) $\times$ B($B_s^0 \rightarrow D_s^-$ 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($\overline{b} \rightarrow B_s^0$) $= 0.107 \pm 0.014$ 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($\overline{b} \rightarrow B_s^0$) and B($D_s \rightarrow \phi\pi$).

[44] ACTON 92N assume that excess of 147 ± 48 D_s^0 events over that expected from B^0, B^+, and $c\overline{c}$ is all from B_s^0 decay. The product branching fraction is measured to be $B(\overline{b} \rightarrow B_s^0)B(B_s^0 \rightarrow D_s^-\text{anything})\times B(D_s^- \rightarrow \phi\pi^-) = (5.9 \pm 1.9 \pm 1.1) \times 10^{-3}$. We evaluate using our current values $B(\overline{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ 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 $B(\overline{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$.

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

The values and averages in this section serve only to show what values result if one assumes our $B(\overline{b} \rightarrow B_s^0)$. They cannot be thought of as measurements since the underlying product branching fractions were also used to determine $B(\overline{b} \rightarrow B_s^0)$ 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	[45] BUSKULIC	95O	ALEP	$e^+e^- \rightarrow Z$
0.107±0.043±0.029		[46] ABREU	92M	DLPH	$e^+e^- \rightarrow Z$
0.103±0.036±0.028	18	[47] 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	[48] BUSKULIC	92E	ALEP	$e^+e^- \rightarrow Z$

[45] BUSKULIC 95O use $D_s\ell$ correlations. The measured product branching ratio is $B(\overline{b} \rightarrow B_s) \times B(B_s \rightarrow D_s^- \ell^+ \nu_\ell \text{anything}) = (0.82 \pm 0.09^{+0.13}_{-0.14})\%$ 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 $B(\overline{b} \rightarrow B_s) = (11.0 \pm 1.2^{+2.5}_{-2.6})\%$. We evaluate using our current values $B(\overline{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ 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 $B(\overline{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$.

[46] ABREU 92M measured muons only and obtained product branching ratio $B(Z \rightarrow b \text{or } \overline{b}) \times B(\overline{b} \rightarrow B_s) \times B(B_s \rightarrow D_s \mu^+ \nu_\mu \text{anything}) \times B(D_s \rightarrow \phi\pi) = (18 \pm 8) \times 10^{-5}$. We evaluate using our current values $B(\overline{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ 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 $B(\overline{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$. We use $B(Z \rightarrow b \text{or } \overline{b}) = 2B(Z \rightarrow b\overline{b}) = 2\times(0.2212 \pm 0.0019)$.

[47] 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 $B(\overline{b} \rightarrow B_s^0)B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{anything}) \times B(D_s^- \rightarrow \phi\pi^-) = (3.9 \pm 1.1 \pm 0.8) \times 10^{-4}$. We evaluate using our current values $B(\overline{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ 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 $B(\overline{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$.

[48] BUSKULIC 92E is measured using $D_s \rightarrow \phi\pi^+$ and $K^*(892)^0 K^+$ events. They use 2.7 ± 0.7% for the $\phi\pi^+$ branching fraction. The average product branching fraction is measured to be $B(\overline{b} \rightarrow B_s^0)B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{anything}) = 0.020 \pm 0.0055^{+0.005}_{-0.006}$. We evaluate using our current values $B(\overline{b} \rightarrow B_s^0) = 0.107 \pm 0.014$ 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 $B(\overline{b} \rightarrow B_s^0)$ and $B(D_s \rightarrow \phi\pi)$. Superseded by BUSKULIC 95O.

$\Gamma(D_s^- \pi^+)/\Gamma_{total}$ Γ_3/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
3.2±0.9 OUR AVERAGE		Error includes scale factor of 1.3.			
3.0±0.7±0.1		[49] ABULENCIA	07C	CDF	$p\overline{p}$ at 1.96 TeV
6.8±2.2±1.6		DRUTSKOY	07A	BELL	$e^+e^- \to \Upsilon(5S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.5±1.1±0.2		[50] ABULENCIA	06J	CDF	Repl. by ABULENCIA 07C
<130	6	[51] AKERS	94J	OPAL	$e^+e^- \to Z$
seen	1	BUSKULIC	93G	ALEP	$e^+e^- \to Z$

[49] ABULENCIA 07C reports $[B(B_s^0 \to D_s^- \pi^+)] / [B(B^0 \to D^- \pi^+)] = 1.13 \pm 0.08 \pm 0.23$. We multiply by our best value $B(B^0 \to D^- \pi^+) = (2.68 \pm 0.13) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[50] ABULENCIA 06J reports $[B(B_s^0 \to D_s^- \pi^+)] / [B(B^0 \to D^- \pi^+)] = 1.32 \pm 0.18 \pm 0.38$. We multiply by our best value $B(B^0 \to D^- \pi^+) = (2.68 \pm 0.13) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[51] AKERS 94J sees ≤ 6 events and measures the limit on the product branching fraction $f(\overline{b} \to B_s^0) \cdot B(B_s^0 \to D_s^- \pi^+) < 1.3\%$ at CL = 90%. We divide by our current value $B(\overline{b} \to B_s^0) = 0.105$.

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

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
8.4±1.9±2.7	[52] ABULENCIA	07C	CDF	$p\overline{p}$ at 1.96 TeV

[52] ABULENCIA 07C reports $[B(B_s^0 \to D_s^- \pi^+ \pi^+ \pi^-)] / [B(B^0 \to D^- \pi^+ \pi^+ \pi^-)] = 1.05 \pm 0.10 \pm 0.22$. We multiply by our best value $B(B^0 \to D^- \pi^+ \pi^+ \pi^-) = (8.0 \pm 2.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^+ D_s^-)/\Gamma_{total}$ Γ_6/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{10.7^{+3.6}_{-3.3} \pm 1.1}$		[53] AALTONEN	08F	CDF	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<67	90	DRUTSKOY	07A	BELL	$e^+e^- \to \Upsilon(5S)$

[53] AALTONEN 08F reports $[B(B_s^0 \to D_s^+ D_s^-)] / [B(B^0 \to D^- D_s^+)] = 1.44^{+0.48}_{-0.44}$. We multiply by our best value $B(B^0 \to D^- D_s^+) = (7.4 \pm 0.7) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

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

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

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

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.049^{+0.029}_{-0.025}}$ **OUR AVERAGE** Error includes scale factor of 1.2.				
$0.039^{+0.019}_{-0.017}{}^{+0.016}_{-0.015}$		[54] ABAZOV 07Y	D0	$p\overline{p}$ at 1.96 TeV
$0.12 \pm 0.05\ ^{+0.10}_{-0.04}$		[55] BARATE 00K	ALEP	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.218	90	BARATE 98Q	ALEP	$e^+e^- \rightarrow Z$

[54] Uses the final states where $D_s^+ \rightarrow \phi\pi^+$ and $D_s^- \rightarrow \phi\mu^-\overline{\nu}_\mu$.

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

$\Gamma(J/\psi(1S)\phi)/\Gamma_{total}$ Γ_9/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.93 \pm 0.28 \pm 0.17}$		[56] ABE 96Q	CDF	$p\overline{p}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<6	1	[57] AKERS 94J	OPAL	$e^+e^- \rightarrow Z$
seen	14	[58] ABE 93F	CDF	$p\overline{p}$ at 1.8 TeV
seen	1	[59] ACTON 92N	OPAL	Sup. by AKERS 94J

[56] ABE 96Q assumes $f_u = f_d$ and $f_s/f_u = 0.40 \pm 0.06$. Uses $B \rightarrow J/\psi(1S) K$ and $B \rightarrow J/\psi(1S) K^*$ branching fractions from PDG 94. They quote two systematic errors, ± 0.10 and ± 0.14 where the latter is the uncertainty in f_s. We combine in quadrature.

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

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

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

$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{total}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN
$\mathbf{<1.2 \times 10^{-3}}$	90	[60] ACCIARRI 97C	L3

[60] ACCIARRI 97C assumes B^0 production fraction (39.5 $\pm$ 4.0%) and B_s (12.0 $\pm$ 3.0%).

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

VALUE	CL%	DOCUMENT ID	TECN
$\mathbf{<3.8 \times 10^{-3}}$	90	[61] ACCIARRI 97C	L3

[61] ACCIARRI 97C assumes B^0 production fraction (39.5 $\pm$ 4.0%) and B_s (12.0 $\pm$ 3.0%).

$\Gamma(\psi(2S)\phi)/\Gamma_{total}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$\mathbf{4.8 \pm 1.4 \pm 1.7}$		[62] ABULENCIA 06N	CDF	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	1	BUSKULIC 93G	ALEP	$e^+e^- \rightarrow Z$

[62] ABULENCIA 06N reports [B($B_s^0 \to \psi(2S)\phi$)] / [B($B_s^0 \to J/\psi(1S)\phi$)] = $0.52 \pm 0.13 \pm 0.07$. We multiply by our best value B($B_s^0 \to J/\psi(1S)\phi$) = $(9.3 \pm 3.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ — Γ_{13}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
< 1.7	90	[63] ABULENCIA,A	06D	CDF	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<232	90	[64] ABE	00C	SLD	$e^+e^- \to Z$
<170	90	[65] BUSKULIC	96V	ALEP	$e^+e^- \to Z$

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

[64] ABE 00C assumes B($Z \to b\overline{b}$)=(21.7 ± 0.1)% and the B fractions $f_{B^0}=f_{B^+}=(39.7^{+1.8}_{-2.2})$% and $f_{B_s}=(10.5^{+1.8}_{-2.2})$%.

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

$\Gamma(\pi^0\pi^0)/\Gamma_{total}$ — Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.1 \times 10^{-4}$	90	[66] ACCIARRI	95H	L3	$e^+e^- \to Z$

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

$\Gamma(\eta\pi^0)/\Gamma_{total}$ — Γ_{15}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.0 \times 10^{-3}$	90	[67] ACCIARRI	95H	L3	$e^+e^- \to Z$

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

$\Gamma(\eta\eta)/\Gamma_{total}$ — Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.5 \times 10^{-3}$	90	[68] ACCIARRI	95H	L3	$e^+e^- \to Z$

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

$\Gamma(\rho^0\rho^0)/\Gamma_{total}$ — Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.20 \times 10^{-4}$	90	[69] ABE	00C	SLD	$e^+e^- \to Z$

[69] ABE 00C assumes B($Z \to b\overline{b}$)=(21.7 ± 0.1)% and the B fractions $f_{B^0}=f_{B^+}=(39.7^{+1.8}_{-2.2})$% and $f_{B_s}=(10.5^{+1.8}_{-2.2})$%.

$\Gamma(\phi\rho^0)/\Gamma_{total}$ — Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.17 \times 10^{-4}$	90	[70] ABE	00C	SLD	$e^+e^- \to Z$

[70] ABE 00C assumes B($Z \to b\overline{b}$)=(21.7 ± 0.1)% and the B fractions $f_{B^0}=f_{B^+}=(39.7^{+1.8}_{-2.2})$% and $f_{B_s}=(10.5^{+1.8}_{-2.2})$%.

$\Gamma(\phi\phi)/\Gamma_{total}$ Γ_{19}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{14^{+6}_{-5}\pm6}$		[71] ACOSTA	05J	CDF	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1183	90	[72] ABE	00C	SLD	$e^+e^- \rightarrow Z$

[71] Uses B($B^0 \rightarrow J/\psi\phi$) = (1.38 ± 0.49) × 10^{-3} and production cross-section ratio of $\sigma(B_s)/\sigma(B^0)$ = 0.26 ± 0.04.

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

$\Gamma(\pi^+K^-)/\Gamma_{total}$ Γ_{20}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
< 5.6	90	[73] ABULENCIA,A	06D	CDF	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<261	90	[74] ABE	00C	SLD	$e^+e^- \rightarrow Z$
<210	90	[75] BUSKULIC	96V	ALEP	$e^+e^- \rightarrow Z$
<260	90	[76] AKERS	94L	OPAL	$e^+e^- \rightarrow Z$

[73] 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 ± 0.039 and B($B^0 \rightarrow K^+\pi^-$) = (18.9 ± 0.7) × 10^{-6}.

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

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

[76] Assumes B($Z \rightarrow b\overline{b}$) = 0.217 and B^0_d (B^0_s) fraction 39.5% (12%).

$\Gamma(K^+K^-)/\Gamma_{total}$ Γ_{21}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
3.3±0.6±0.7		[77] ABULENCIA,A	06D	CDF	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<31	90	DRUTSKOY	07A	BELL	$e^+e^- \rightarrow \Upsilon(5S)$
<28.3	90	[78] ABE	00C	SLD	$e^+e^- \rightarrow Z$
< 5.9	90	[79] BUSKULIC	96V	ALEP	$e^+e^- \rightarrow Z$
<14	90	[80] AKERS	94L	OPAL	$e^+e^- \rightarrow Z$

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

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

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

[80] Assumes B($Z \rightarrow b\overline{b}$) = 0.217 and B^0_d (B^0_s) fraction 39.5% (12%).

$\Gamma(\overline{K}^*(892)^0 \rho^0)/\Gamma_{total}$ — Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<7.67 × 10^{-4}	90	[81] ABE	00C	SLD	$e^+ e^- \rightarrow Z$

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

$\Gamma(\overline{K}^*(892)^0 K^*(892)^0)/\Gamma_{total}$ — Γ_{23}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<16.81 × 10^{-4}	90	[82] ABE	00C	SLD	$e^+ e^- \rightarrow Z$

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

$\Gamma(\phi K^*(892)^0)/\Gamma_{total}$ — Γ_{24}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<10.13 × 10^{-4}	90	[83] ABE	00C	SLD	$e^+ e^- \rightarrow Z$

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

$\Gamma(p\overline{p})/\Gamma_{total}$ — Γ_{25}/Γ

Test for ΔB=1 weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<5.9 × 10^{-5}	90	[84] BUSKULIC	96V	ALEP	$e^+ e^- \rightarrow Z$

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

$\Gamma(\gamma\gamma)/\Gamma_{total}$ — Γ_{26}/Γ

Test for ΔB=1 weak neutral current.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
< 5.3 × 10^{-5}	90	DRUTSKOY	07A	BELL	$e^+ e^- \rightarrow \Upsilon(5S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<14.8 × 10^{-5}	90	[85] ACCIARRI	95I	L3	$e^+ e^- \rightarrow Z$

[85] ACCIARRI 95I assumes f_{B^0} = 39.5 ± 4.0 and f_{B_s} = 12.0 ± 3.0%.

$\Gamma(\phi\gamma)/\Gamma_{total}$ — Γ_{27}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.2 × 10^{-4}	90	ACOSTA	02G	CDF	$p\overline{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.9 × 10^{-4}	90	DRUTSKOY	07A	BELL	$e^+ e^- \rightarrow \Upsilon(5S)$
<7 × 10^{-4}	90	[86] ADAM	96D	DLPH	$e^+ e^- \rightarrow Z$

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

$\Gamma(\mu^+\mu^-)/\Gamma_{total}$ — Γ_{28}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<4.7 \times 10^{-8}$	90	[87] AALTONEN	08I	CDF	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<9.4 \times 10^{-8}$	90	[88] ABAZOV	07Q	D0	$p\overline{p}$ at 1.96 TeV
$<4.1 \times 10^{-7}$	90	[89] ABAZOV	05E	D0	$p\overline{p}$ at 1.96 TeV
$<1.5 \times 10^{-7}$	90	[90] ABULENCIA	05	CDF	$p\overline{p}$ at 1.96 TeV
$<5.8 \times 10^{-7}$	90	[91] ACOSTA	04D	CDF	$p\overline{p}$ at 1.96 TeV
$<2.0 \times 10^{-6}$	90	[92] ABE	98	CDF	$p\overline{p}$ at 1.8 TeV
$<3.8 \times 10^{-5}$	90	[93] ACCIARRI	97B	L3	$e^+e^- \to Z$
$<8.4 \times 10^{-6}$	90	[94] ABE	96L	CDF	Repl. by ABE 98

[87] Uses B production ratio $f(\overline{b} \to B^+)/f(\overline{b} \to B^0_s) = 3.86 \pm 0.59$, and the number of $B^+ \to J/\psi K^+$ decays.

[88] Uses B production ratio $f(\overline{b} \to B^+)/f(\overline{b} \to B^0_s) = 3.86 \pm 0.54$ and the number of $B^+ \to J/\psi K^+$ decays.

[89] Assumes production cross-section $\sigma(B_s)/\sigma(B^+) = 0.270 \pm 0.034$.

[90] Assumes production cross section $\sigma(B^+)/\sigma(B_s) = 3.71 \pm 0.41$ and $B(B^+ \to J/\psi K^+ \to \mu^+\mu^- K^+) = (5.88 \pm 0.26) \times 10^{-5}$.

[91] Assumes production cross-section $\sigma(B_s)/\sigma(B^+) = 0.100/0.391$ and the CDF measured value of $\sigma(B^+) = 3.6 \pm 0.6\ \mu$b.

[92] ABE 98 assumes production of $\sigma(B^0) = \sigma(B^+)$ and $\sigma(B_s)/\sigma(B^0) = 1/3$. They normalize to their measured $\sigma(B^0, p_T(B) > 6, |y| < 1.0) = 2.39 \pm 0.32 \pm 0.44\ \mu$b.

[93] ACCIARRI 97B assume PDG 96 production fractions for B^+, B^0, B_s, and Λ_b.

[94] ABE 96L assumes B^+/B_s production ratio 3/1. They normalize to their measured $\sigma(B^+, p_T(B) > 6$ GeV/c, $|y| < 1) = 2.39 \pm 0.54\ \mu$b.

$\Gamma(e^+e^-)/\Gamma_{total}$ — Γ_{29}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<5.4 \times 10^{-5}$	90	[95] ACCIARRI	97B	L3	$e^+e^- \to Z$

[95] ACCIARRI 97B assume PDG 96 production fractions for B^+, B^0, B_s, and Λ_b.

$\Gamma(e^\pm\mu^\mp)/\Gamma_{total}$ — Γ_{30}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.1 \times 10^{-6}$	90	ABE	98V	CDF	$p\overline{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<4.1 \times 10^{-5}$	90	[96] ACCIARRI	97B	L3	$e^+e^- \to Z$

[96] ACCIARRI 97B assume PDG 96 production fractions for B^+, B^0, B_s, and Λ_b.

$\Gamma(\phi(1020)\mu^+\mu^-)/\Gamma_{total}$ — Γ_{31}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.2 \times 10^{-6}$	90	[97] ABAZOV	06G	D0	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<4.7 \times 10^{-5}$	90	ACOSTA	02D	CDF	$p\overline{p}$ at 1.8 TeV

[97] Uses $B(B^0_s \to J/\psi\phi) = 9.3 \times 10^{-4}$.

$\Gamma(\phi\nu\overline{\nu})/\Gamma_{total}$ — Γ_{32}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<5.4 × 10^{-3}	90	[98] ADAM	96D	DLPH	$e^+ e^- \rightarrow Z$

[98] 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
0.533±0.021 OUR AVERAGE					
0.531±0.020±0.007		[99] AALTONEN	08J	CDF	$p\overline{p}$ at 1.96 TeV
0.61 ±0.14 ±0.02		[100] AFFOLDER	00N	CDF	$p\overline{p}$ at 1.8 TeV
0.56 ±0.21 $^{+0.02}_{-0.04}$	19	ABE	95Z	CDF	$p\overline{p}$ at 1.8 TeV

[99] Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.

[100] 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 $0.23 \pm 0.19 \pm 0.04$.

$\Gamma_\perp/\Gamma$ in $B_s^0 \rightarrow J/\psi(1S)\phi$

VALUE	DOCUMENT ID		TECN	COMMENT
0.239±0.029±0.011	[101] AALTONEN	08J	CDF	$p\overline{p}$ at 1.96 TeV

[101] Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.

B_s^0-$\overline{B}_s^0$ MIXING

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

χ_s is a measure of the time-integrated B_s^0-$\overline{B}_s^0$ mixing probability that produced $B_s^0(\overline{B}_s^0)$ decays as a $\overline{B}_s^0(B_s^0)$. 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 $\tau_{B_s^0} = \frac{1}{0.5(\Gamma_{B_{sH}^0}+\Gamma_{B_{sL}^0})}$.

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

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

VALUE (10^{12} $\hbar$ s^{-1})	CL%	DOCUMENT ID		TECN	COMMENT
17.77±0.10±0.07		[102] ABULENCIA,A	06G	CDF	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
17–21	90	[103] ABAZOV	06B	D0	$p\overline{p}$ at 1.96 TeV
$17.31^{+0.33}_{-0.18}\pm0.07$		[104] ABULENCIA	06Q	CDF	Repl. by ABULENCIA,A 06G
$>$ 8.0	95	[105] ABDALLAH	04J	DLPH	$e^+e^- \rightarrow Z^0$
$>$ 4.9	95	[106] ABDALLAH	04J	DLPH	$e^+e^- \rightarrow Z^0$
$>$ 8.5	95	[107] ABDALLAH	04J	DLPH	$e^+e^- \rightarrow Z^0$
$>$ 5.0	95	[108] ABDALLAH	03B	DLPH	$e^+e^- \rightarrow Z$
$>$10.3	95	[109] ABE	03	SLD	$e^+e^- \rightarrow Z$
$>$10.9	95	[110] HEISTER	03E	ALEP	$e^+e^- \rightarrow Z$
$>$ 5.3	95	[111] ABE	02V	SLD	$e^+e^- \rightarrow Z$
$>$ 1.0	95	[112] ABBIENDI	01D	OPAL	$e^+e^- \rightarrow Z$
$>$ 7.4	95	[113] ABREU	00Y	DLPH	Repl. by ABDALLAH 04J
$>$ 4.0	95	[114] ABREU,P	00G	DLPH	$e^+e^- \rightarrow Z$
$>$ 5.2	95	[115] ABBIENDI	99S	OPAL	$e^+e^- \rightarrow Z$
$<$96	95	[116] ABE	99D	CDF	$p\overline{p}$ at 1.8 TeV
$>$ 5.8	95	[117] ABE	99J	CDF	$p\overline{p}$ at 1.8 TeV
$>$ 9.6	95	[118] BARATE	99J	ALEP	$e^+e^- \rightarrow Z$
$>$ 7.9	95	[119] BARATE	98C	ALEP	Repl. by BARATE 99J
$>$ 3.1	95	[120] ACKERSTAFF	97U	OPAL	Repl. by ABBIENDI 99S
$>$ 2.2	95	[121] ACKERSTAFF	97V	OPAL	Repl. by ABBIENDI 99S
$>$ 6.5	95	[122] ADAM	97	DLPH	Repl. by ABREU 00Y
$>$ 6.6	95	[123] BUSKULIC	96M	ALEP	Repl. by BARATE 98C
$>$ 2.2	95	[121] AKERS	95J	OPAL	Sup. by ACKERSTAFF 97V
$>$ 5.7	95	[124] BUSKULIC	95J	ALEP	$e^+e^- \rightarrow Z$
$>$ 1.8	95	[121] BUSKULIC	94B	ALEP	$e^+e^- \rightarrow Z$

[102] Significance of oscillation signal is 5.4 σ. Also reports $\left|V_{td} / V_{ts}\right| = 0.2060 \pm 0.0007^{+0.0081}_{-0.0060}$.

[103] A likelihood scan over the oscillation frequency, Δm_s, gives a most probable value of 19 ps^{-1} and a range of $17 < \Delta m_s < 21$ (ps^{-1}) at 90% C.L. assuming Gaussian uncertainties. Also excludes $\Delta m_s < 14.8$ ps^{-1} at 95% C.L

[104] Significance of oscillation signal is 0.2%. Also reported the value $\left|V_{td} / V_{ts}\right| = 0.208^{+0.001}_{-0.002}{}^{+0.008}_{-0.006}$.

[105] Uses leptons emitted with large momentum transverse to a jet and improved techniques for vertexing and flavor-tagging.

[106] Updates of D_s-lepton analysis.

[107] Combined results from all Delphi analyses.

[108] Events with a high transverse momentum lepton were removed and an inclusively reconstructed vertex was required.

[109] 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 $\Delta m_s < 4.9$ ps^{-1} and $7.9 < \Delta m_s < 10.3$ ps^{-1}.

[110] Three analyses based on complementary event selections: (1) fully-reconstructed hadronic decays; (2) semileptonic decays with D_s exclusively reconstructed; (3) inclusive semileptonic decays.

[111] ABE 02V uses exclusively reconstructed D_s^- mesons and excludes $\Delta m_s < 1.4\,\mathrm{ps}^{-1}$ and $2.4 < \Delta m_s < 5.3\,\mathrm{ps}^{-1}$ at 95%CL.

[112] Uses fully or partially reconstructed $D_s \ell$ vertices and a mixing tag as a flavor tagging.

[113] Replaced by ABDALLAH 04A. Uses $D_s^- \ell^+$, and $\phi \ell^+$ vertices, and a multi-variable discriminant as a flavor tagging.

[114] Uses inclusive D_s vertices and fully reconstructed B_s decays and a multi-variable discriminant as a flavor tagging.

[115] Uses ℓ-Q_{hem} and ℓ-ℓ.

[116] ABE 99D assumes $\tau_{B_s^0} = 1.55 \pm 0.05$ ps and $\Delta\Gamma/\Delta m = (5.6 \pm 2.6) \times 10^{-3}$.

[117] ABE 99J uses ϕ ℓ-ℓ correlation.

[118] BARATE 99J uses combination of an inclusive lepton and D_s^--based analyses.

[119] BARATE 98C combines results from $D_s h$-ℓ/Q_{hem}, $D_s h$-K in the same side, $D_s \ell$-ℓ/Q_{hem} and $D_s \ell$-K in the same side.

[120] Uses ℓ-Q_{hem}.

[121] Uses ℓ-ℓ.

[122] ADAM 97 combines results from $D_s \ell$-Q_{hem}, ℓ-Q_{hem}, and ℓ-ℓ.

[123] BUSKULIC 96M uses D_s lepton correlations and lepton, kaon, and jet charge tags.

[124] 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*
26.1±0.5 OUR EVALUATION	

χ_s

This B_s^0-$\overline{B}_s^0$ integrated mixing parameter is derived from x_s above.

VALUE	*DOCUMENT ID*
0.49927±0.00003 OUR EVALUATION	

CP VIOLATION PARAMETERS in B_s^0

$\mathrm{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2)$

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 ID*		*TECN*	*COMMENT*
−0.75±2.52 OUR EVALUATION				
6.1 ±4.8 ±0.9	[125] ABAZOV	07A	D0	$p\overline{p}$ at 1.96 TeV

[125] The first direct measurement of the time integrated flavor untagged charge asymmetry in semileptonic B^0_s decays is reported as $2\text{x}A^s_{SL}$(untagged) = A^s_{SL} = $(2.45 \pm 1.93 \pm 0.35) \times 10^{-2}$.

CP Violation phase β_s in the B^0_s System

β_s is the *CP*-violating phase, defined as $\beta_s = \arg(-\frac{V_{ts}V^*_{td}}{V_{cs}V^*_{cb}})$.

VALUE	DOCUMENT ID		TECN	COMMENT
0.35 $^{+0.20}_{-0.24}$	[126,127] ABAZOV	07N	D0	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
	[128] AALTONEN	08G	CDF	$p\overline{p}$ at 1.96 GeV
$0.395 \pm 0.280^{+0.005}_{-0.070}$	[126,129] ABAZOV	07	D0	Repl. by ABAZOV 07N

[126] Reports ϕ_s which equals to $-2\beta_s$.
[127] Combines D^0 measurements of time-dependent angular distributions in $B^0_s \to J/\psi\phi$ and charge asymmetry in semileptonic decays. There is a 4-fold ambiguity in the solution.
[128] 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 $B^0_s \to J/\psi\phi$ decays using flavor tagging. The probability of a deviation from SM prediction as large as the level of observed data is 15%.
[129] The first direct measurement of the *CP*-violating mixing phase is reported from the time-dependent analysis of flavor untagged $B^0_s \to J/\psi\phi$ decays.

B^0_s REFERENCES

AALTONEN	08F	PRL 100 021803	T. Aaltonen *et al.*	(CDF Collab.)
AALTONEN	08G	PRL 100 161802	T. Aaltonen *et al.*	(CDF Collab.)
AALTONEN	08I	PRL 100 101802	T. Aaltonen *et al.*	(CDF Collab.)
AALTONEN	08J	PRL 100 121803	T. Aaltonen *et al.*	(CDF Collab.)
ABAZOV	07	PRL 98 121801	V.M. Abazov *et al.*	(D0 Collab.)
ABAZOV	07A	PRL 98 151801	V.M. Abazov *et al.*	(D0 Collab.)
ABAZOV	07N	PR D76 057101	V.M. Abazov *et al.*	(D0 Collab.)
ABAZOV	07Q	PR D76 092001	V.M. Abazov *et al.*	(D0 Collab.)
ABAZOV	07Y	PRL 99 241801	V.M. Abazov *et al.*	(D0 Collab.)
ABULENCIA	07C	PRL 98 061802	A. Abulencia *et al.*	(FNAL CDF Collab.)
DRUTSKOY	07	PRL 98 052001	A. Drutskoy *et al.*	(BELLE Collab.)
DRUTSKOY	07A	PR D76 012002	A. Drutskoy *et al.*	(BELLE Collab.)
ABAZOV	06B	PRL 97 021802	V.M. Abazov *et al.*	(D0 Collab.)
ABAZOV	06G	PR D74 031107R	V.M. Abazov *et al.*	(D0 Collab.)
ABAZOV	06V	PRL 97 241801	V.M. Abazov *et al.*	(D0 Collab.)
ABULENCIA	06J	PRL 96 191801	A. Abulencia *et al.*	(CDF Collab.)
ABULENCIA	06N	PRL 96 231801	A. Abulencia *et al.*	(CDF Collab.)
ABULENCIA	06Q	PRL 97 062003	A. Abulencia *et al.*	(CDF Collab.)
ABULENCIA,A	06D	PRL 97 211802	A. Abulencia *et al.*	(CDF Collab.)
ABULENCIA,A	06G	PRL 97 242003	A. Abulencia *et al.*	(CDF Collab.)
ACOSTA	06	PRL 96 202001	D. Acosta *et al.*	(CDF Collab.)
ABAZOV	05B	PRL 94 042001	V.M. Abazov *et al.*	(D0 Collab.)
ABAZOV	05E	PRL 94 071802	V.M. Abazov *et al.*	(D0 Collab.)
ABAZOV	05W	PRL 95 171801	V.M. Abazov *et al.*	(D0 Collab.)
ABULENCIA	05	PRL 95 221805	A. Abulencia *et al.*	(CDF Collab.)
Also		PRL 95 249905 (erratum)	A. Abulencia *et al.*	(CDF Collab.)
ACOSTA	05	PRL 94 101803	D. Acosta *et al.*	(CDF Collab.)
ACOSTA	05J	PRL 95 031801	D. Acosta *et al.*	(CDF Collab.)
ABDALLAH	04A	PL B585 63	J. Abdallah *et al.*	(DELPHI Collab.)
ABDALLAH	04J	EPJ C35 35	J. Abdallah *et al.*	(DELPHI Collab.)
ACOSTA	04D	PRL 93 032001	D. Acosta *et al.*	(CDF Collab.)
ABDALLAH	03B	EPJ C28 155	J. Abdallah *et al.*	(DELPHI Collab.)

ABE	03	PR D67 012006	K. Abe *et al.*	(SLD Collab.)
HEISTER	03E	EPJ C29 143	A. Heister *et al.*	(ALEPH Collab.)
ABE	02V	PR D66 032009	K. Abe *et al.*	(SLD Collab.)
ACOSTA	02D	PR D65 111101R	D. Acosta *et al.*	(CDF Collab.)
ACOSTA	02G	PR D66 112002	D. Acosta *et al.*	(CDF Collab.)
ABBIENDI	01D	EPJ C19 241	G. Abbiendi *et al.*	(OPAL Collab.)
ABE	00C	PR D62 071101R	K. Abe *et al.*	(SLD Collab.)
ABREU	00Y	EPJ C16 555	P. Abreu *et al.*	(DELPHI Collab.)
ABREU,P	00G	EPJ C18 229	P. Abreu *et al.*	(DELPHI Collab.)
AFFOLDER	00N	PRL 85 4668	T. Affolder *et al.*	(CDF Collab.)
BARATE	00K	PL B486 286	R. Barate *et al.*	(ALEPH Collab.)
ABBIENDI	99S	EPJ C11 587	G. Abbiendi *et al.*	(OPAL Collab.)
ABE	99D	PR D59 032004	F. Abe *et al.*	(CDF Collab.)
ABE	99J	PRL 82 3576	F. Abe *et al.*	(CDF Collab.)
BARATE	99J	EPJ C7 553	R. Barate *et al.*	(ALEPH Collab.)
Also		EPJ C12 181 (erratum)	R. Barate *et al.*	(ALEPH Collab.)
ABE	98	PR D57 R3811	F. Abe *et al.*	(CDF Collab.)
ABE	98B	PR D57 5382	F. Abe *et al.*	(CDF Collab.)
ABE	98V	PRL 81 5742	F. Abe *et al.*	(CDF Collab.)
ACCIARRI	98S	PL B438 417	M. Acciarri *et al.*	(L3 Collab.)
ACKERSTAFF	98F	EPJ C2 407	K. Ackerstaff *et al.*	(OPAL Collab.)
ACKERSTAFF	98G	PL B426 161	K. Ackerstaff *et al.*	(OPAL Collab.)
BARATE	98C	EPJ C4 367	R. Barate *et al.*	(ALEPH Collab.)
BARATE	98Q	EPJ C4 387	R. Barate *et al.*	(ALEPH Collab.)
PDG	98	EPJ C3 1	C. Caso *et al.*	
ACCIARRI	97B	PL B391 474	M. Acciarri *et al.*	(L3 Collab.)
ACCIARRI	97C	PL B391 481	M. Acciarri *et al.*	(L3 Collab.)
ACKERSTAFF	97U	ZPHY C76 401	K. Ackerstaff *et al.*	(OPAL Collab.)
ACKERSTAFF	97V	ZPHY C76 417	K. Ackerstaff *et al.*	(OPAL Collab.)
ADAM	97	PL B414 382	W. Adam *et al.*	(DELPHI Collab.)
ABE	96B	PR D53 3496	F. Abe *et al.*	(CDF Collab.)
ABE	96L	PRL 76 4675	F. Abe *et al.*	(CDF Collab.)
ABE	96N	PRL 77 1945	F. Abe *et al.*	(CDF Collab.)
ABE	96Q	PR D54 6596	F. Abe *et al.*	(CDF Collab.)
ABREU	96F	ZPHY C71 11	P. Abreu *et al.*	(DELPHI Collab.)
ADAM	96D	ZPHY C72 207	W. Adam *et al.*	(DELPHI Collab.)
BUSKULIC	96E	ZPHY C69 585	D. Buskulic *et al.*	(ALEPH Collab.)
BUSKULIC	96M	PL B377 205	D. Buskulic *et al.*	(ALEPH Collab.)
BUSKULIC	96V	PL B384 471	D. Buskulic *et al.*	(ALEPH Collab.)
PDG	96	PR D54 1	R. M. Barnett *et al.*	
ABE	95R	PRL 74 4988	F. Abe *et al.*	(CDF Collab.)
ABE	95Z	PRL 75 3068	F. Abe *et al.*	(CDF Collab.)
ACCIARRI	95H	PL B363 127	M. Acciarri *et al.*	(L3 Collab.)
ACCIARRI	95I	PL B363 137	M. Acciarri *et al.*	(L3 Collab.)
AKERS	95G	PL B350 273	R. Akers *et al.*	(OPAL Collab.)
AKERS	95J	ZPHY C66 555	R. Akers *et al.*	(OPAL Collab.)
BUSKULIC	95J	PL B356 409	D. Buskulic *et al.*	(ALEPH Collab.)
BUSKULIC	95O	PL B361 221	D. Buskulic *et al.*	(ALEPH Collab.)
ABREU	94D	PL B324 500	P. Abreu *et al.*	(DELPHI Collab.)
ABREU	94E	ZPHY C61 407	P. Abreu *et al.*	(DELPHI Collab.)
Also		PL B289 199	P. Abreu *et al.*	(DELPHI Collab.)
AKERS	94J	PL B337 196	R. Akers *et al.*	(OPAL Collab.)
AKERS	94L	PL B337 393	R. Akers *et al.*	(OPAL Collab.)
BUSKULIC	94B	PL B322 441	D. Buskulic *et al.*	(ALEPH Collab.)
BUSKULIC	94C	PL B322 275	D. Buskulic *et al.*	(ALEPH Collab.)
PDG	94	PR D50 1173	L. Montanet *et al.*	(CERN, LBL, BOST+)
ABE	93F	PRL 71 1685	F. Abe *et al.*	(CDF Collab.)
ACTON	93H	PL B312 501	P.D. Acton *et al.*	(OPAL Collab.)
BUSKULIC	93G	PL B311 425	D. Buskulic *et al.*	(ALEPH Collab.)
ABREU	92M	PL B289 199	P. Abreu *et al.*	(DELPHI Collab.)
ACTON	92N	PL B295 357	P.D. Acton *et al.*	(OPAL Collab.)
BUSKULIC	92E	PL B294 145	D. Buskulic *et al.*	(ALEPH Collab.)
LEE-FRANZINI	90	PRL 65 2947	J. Lee-Franzini *et al.*	(CUSB II Collab.)