

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

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

### $B_s^0$ MASS

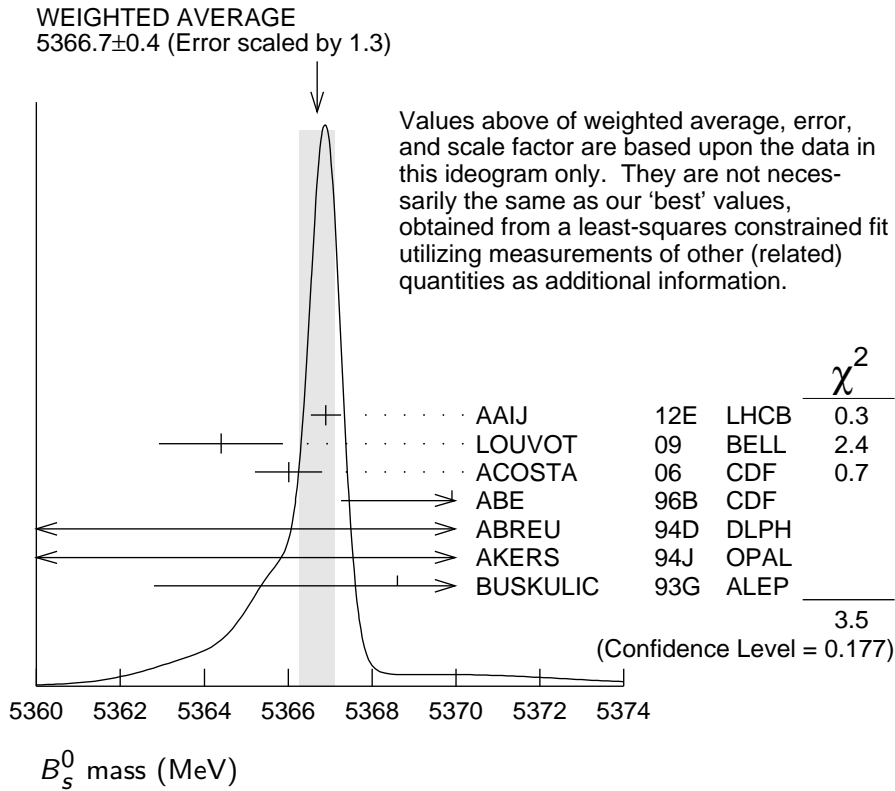
<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>5366.77 ± 0.24 OUR FIT</b>				
<b>5366.7 ± 0.4 OUR AVERAGE</b>				Error includes scale factor of 1.3. See the ideogram below.
5366.90 ± 0.28 ± 0.23		<sup>1</sup> AAIJ	12E LHCb	$p\bar{p}$ at 7 TeV
5364.4 ± 1.3 ± 0.7		LOUVOT	09 BELL	$e^+e^- \rightarrow \gamma(5S)$
5366.01 ± 0.73 ± 0.33		<sup>2</sup> ACOSTA	06 CDF	$p\bar{p}$ at 1.96 TeV
5369.9 ± 2.3 ± 1.3	32	<sup>3</sup> 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	<sup>3</sup> 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	<sup>4</sup> AKERS	94J OPAL	$e^+e^- \rightarrow Z$
5383.3 ± 4.5 ± 5.0	14	ABE	93F CDF	Repl. by ABE 96B

<sup>1</sup> Uses  $B_s^0 \rightarrow J/\psi\phi$  fully reconstructed decays.

<sup>2</sup> Uses exclusively reconstructed final states containing a  $J/\psi \rightarrow \mu^+\mu^-$  decays.

<sup>3</sup> From the decay  $B_s \rightarrow J/\psi(1S)\phi$ .

<sup>4</sup> 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
<b><math>87.35 \pm 0.23</math></b>				<b>OUR FIT</b>
<b><math>87.34 \pm 0.29</math></b>				<b>OUR AVERAGE</b>
$87.42 \pm 0.30 \pm 0.09$		<sup>1</sup> AAIJ	12E LHCB	$pp$ at 7 TeV
$86.64 \pm 0.80 \pm 0.08$		<sup>2</sup> ACOSTA	06 CDF	$p\bar{p}$ at 1.96 TeV
• • •				We use the following data for averages but not for fits. • • •
$89.7 \pm 2.7 \pm 1.2$		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	$e^+e^- \rightarrow \gamma(5S)$
<sup>1</sup> The reported result is $m_{B_s^0} - m_{B^+} = 87.52 \pm 0.30 \pm 0.12$ MeV. We convert it to the mass difference with respect to the average of $(m_{B^\pm} + m_{B^0})/2$ .				
<sup>2</sup> 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 $(m_{B^\pm} + m_{B^0})/2$ .				

$$m_{B_{sH}^0} - m_{B_{sL}^0}$$

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  $1 / [0.5 (\Gamma_{B_{sL}^0} + \Gamma_{B_{sH}^0})]$ .

The Second “OUR EVALUATION” is the average of  $B_S \rightarrow D_S X$  data listed below.

<u>VALUE (<math>10^{-12}</math> s)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.516±0.011 OUR EVALUATION</b>		First		
<b>1.463±0.032 OUR EVALUATION</b>		Second		
1.518±0.041±0.027		<sup>1</sup> AALTONEN	11AP CDF	$p\bar{p}$ at 1.96 TeV
1.398±0.044 <sup>+0.028</sup> <sub>-0.025</sub>		<sup>2</sup> ABAZOV	06V D0	$p\bar{p}$ at 1.96 TeV
1.42 <sup>+0.14</sup> <sub>-0.13</sub> ±0.03		<sup>3</sup> ABREU	00Y DLPH	$e^+e^- \rightarrow Z$
1.53 <sup>+0.16</sup> <sub>-0.15</sub> ±0.07		<sup>4</sup> ABREU,P	00G DLPH	$e^+e^- \rightarrow Z$
1.36 ±0.09 <sup>+0.06</sup> <sub>-0.05</sub>		<sup>5</sup> ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
1.72 <sup>+0.20</sup> <sub>-0.19</sub> <sup>+0.18</sup> <sub>-0.17</sub>		<sup>6</sup> ACKERSTAFF	98F OPAL	$e^+e^- \rightarrow Z$
1.50 <sup>+0.16</sup> <sub>-0.15</sub> ±0.04		<sup>5</sup> ACKERSTAFF	98G OPAL	$e^+e^- \rightarrow Z$
1.47 ±0.14 ±0.08		<sup>4</sup> BARATE	98C ALEP	$e^+e^- \rightarrow Z$
1.54 <sup>+0.14</sup> <sub>-0.13</sub> ±0.04		<sup>5</sup> BUSKULIC	96M ALEP	$e^+e^- \rightarrow Z$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.51 ±0.11		<sup>7</sup> BARATE	98C ALEP	$e^+e^- \rightarrow Z$
1.56 <sup>+0.29</sup> <sub>-0.26</sub> <sup>+0.08</sup> <sub>-0.07</sub>		<sup>5</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.65 <sup>+0.34</sup> <sub>-0.31</sub> ±0.12		<sup>4</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.76 ±0.20 <sup>+0.15</sup> <sub>-0.10</sub>		<sup>8</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.60 ±0.26 <sup>+0.13</sup> <sub>-0.15</sub>		<sup>9</sup> ABREU	96F DLPH	Repl. by ABREU,P 00G
1.67 ±0.14		<sup>10</sup> ABREU	96F DLPH	$e^+e^- \rightarrow Z$
1.61 <sup>+0.30</sup> <sub>-0.29</sub> <sup>+0.18</sup> <sub>-0.16</sub>	90	<sup>4</sup> BUSKULIC	96E ALEP	Repl. by BARATE 98C
1.42 <sup>+0.27</sup> <sub>-0.23</sub> ±0.11	76	<sup>5</sup> ABE	95R CDF	Repl. by ABE 99D

1.74	$\begin{matrix} +1.08 \\ -0.69 \end{matrix}$	$\pm 0.07$	8	<sup>11</sup> ABE	95R CDF	Sup. by ABE 96N
1.54	$\begin{matrix} +0.25 \\ -0.21 \end{matrix}$	$\pm 0.06$	79	<sup>5</sup> AKERS	95G OPAL	Repl. by ACKERSTAFF 98G
1.59	$\begin{matrix} +0.17 \\ -0.15 \end{matrix}$	$\pm 0.03$	134	<sup>5</sup> BUSKULIC	95O ALEP	Sup. by BUSKULIC 96M
0.96	$\pm 0.37$		41	<sup>12</sup> ABREU	94E DLPH	Sup. by ABREU 96F
1.92	$\begin{matrix} +0.45 \\ -0.35 \end{matrix}$	$\pm 0.04$	31	<sup>5</sup> BUSKULIC	94C ALEP	Sup. by BUSKULIC 95O
1.13	$\begin{matrix} +0.35 \\ -0.26 \end{matrix}$	$\pm 0.09$	22	<sup>5</sup> ACTON	93H OPAL	Sup. by AKERS 95G

<sup>1</sup> AALTONEN 11AP combines the fully reconstructed  $B_S^0 \rightarrow D_S^- \pi^+$  decays and partially reconstructed  $B_S^0 \rightarrow D_S X$  decays.

<sup>2</sup> Measured using  $D_S \mu^+$  vertices.

<sup>3</sup> Uses  $D_S^- \ell^+$ , and  $\phi \ell^+$  vertices.

<sup>4</sup> Measured using  $D_S$  hadron vertices.

<sup>5</sup> Measured using  $D_S^- \ell^+$  vertices.

<sup>6</sup> ACKERSTAFF 98F use fully reconstructed  $D_S^- \rightarrow \phi \pi^-$  and  $D_S^- \rightarrow K^{*0} K^-$  in the inclusive  $B_S^0$  decay.

<sup>7</sup> Combined results from  $D_S^- \ell^+$  and  $D_S$  hadron.

<sup>8</sup> Measured using  $\phi \ell$  vertices.

<sup>9</sup> Measured using inclusive  $D_S$  vertices.

<sup>10</sup> Combined result for the four ABREU 96F methods.

<sup>11</sup> Exclusive reconstruction of  $B_S \rightarrow \psi \phi$ .

<sup>12</sup> ABREU 94E uses the flight-distance distribution of  $D_S$  vertices,  $\phi$ -lepton vertices, and  $D_S \mu$  vertices.

## $B_S^0$ MEAN LIFE (Flavor specific)

<u>VALUE (<math>10^{-12}</math> s)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.463 ± 0.032 OUR EVALUATION</b>			
<b>1.456 ± 0.031 OUR AVERAGE</b>			
1.518 ± 0.041 ± 0.027	<sup>1</sup> AALTONEN	11AP CDF	$\rho \bar{p}$ at 1.96 TeV
1.398 ± 0.044 $\begin{matrix} +0.028 \\ -0.025 \end{matrix}$	<sup>2</sup> ABAZOV	06V D0	$\rho \bar{p}$ at 1.96 TeV
1.42 $\begin{matrix} +0.14 \\ -0.13 \end{matrix}$ ± 0.03	<sup>3</sup> ABREU	00Y DLPH	$e^+ e^- \rightarrow Z$
1.36 ± 0.09 $\begin{matrix} +0.06 \\ -0.05 \end{matrix}$	<sup>4</sup> ABE	99D CDF	$\rho \bar{p}$ at 1.8 TeV
1.50 $\begin{matrix} +0.16 \\ -0.15 \end{matrix}$ ± 0.04	<sup>4</sup> ACKERSTAFF	98G OPAL	$e^+ e^- \rightarrow Z$
1.54 $\begin{matrix} +0.14 \\ -0.13 \end{matrix}$ ± 0.04	<sup>4</sup> BUSKULIC	96M ALEP	$e^+ e^- \rightarrow Z$

<sup>1</sup> AALTONEN 11AP combines the fully reconstructed  $B_S^0 \rightarrow D_S^- \pi^+$  decays and partially reconstructed  $B_S^0 \rightarrow D_S X$  decays.

<sup>2</sup> Measured using  $D_S^- \mu^+$  vertices.

<sup>3</sup> Uses  $D_S^- \ell^+$ , and  $\phi \ell^+$  vertices.

<sup>4</sup> Measured using  $D_S^- \ell^+$  vertices.

## $B_s^0$ MEAN LIFE ( $B_S \rightarrow J/\psi\phi$ )

<u>VALUE (<math>10^{-12}</math> s)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.429 ± 0.088 OUR EVALUATION</b>			
<b>1.517 ± 0.026 OUR AVERAGE</b>			
1.529 ± 0.025 ± 0.012	<sup>1</sup> AALTONEN	12D CDF	$\rho\bar{p}$ at 1.96 TeV
1.444 $^{+0.098}_{-0.090}$ ± 0.020	<sup>2</sup> ABAZOV	05B D0	$\rho\bar{p}$ at 1.96 TeV
1.40 $^{+0.15}_{-0.13}$ ± 0.02	<sup>1</sup> ACOSTA	05 CDF	$\rho\bar{p}$ at 1.96 TeV
1.34 $^{+0.23}_{-0.19}$ ± 0.05	<sup>1</sup> ABE	98B CDF	$\rho\bar{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.39 $^{+0.13}_{-0.16}$ $^{+0.01}_{-0.02}$	<sup>1</sup> ABAZOV	05W D0	$\rho\bar{p}$ at 1.96 TeV
1.34 $^{+0.23}_{-0.19}$ ± 0.05	<sup>3</sup> ABE	96N CDF	Repl. by ABE 98B
<sup>1</sup> Measured using the time-dependent angular analysis of $B_S^0 \rightarrow J/\psi\phi$ decays.			
<sup>2</sup> Measured using fully reconstructed $B_S \rightarrow J/\psi\phi$ decays.			
<sup>3</sup> ABE 96N uses $58 \pm 12$ exclusive $B_S \rightarrow J/\psi\phi$ events.			

## $\tau_{B_s^0}/\tau_{B^0}$ MEAN LIFE RATIO

### $\tau_{B_s^0}/\tau_{B^0}$ (direct measurements)

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.052 ± 0.061 ± 0.015</b>			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.980 $^{+0.076}_{-0.071}$ ± 0.003	<sup>2</sup> ABAZOV	05B D0	Repl. by ABAZOV 05W
0.91 ± 0.09 ± 0.003	<sup>3</sup> ABAZOV	05W D0	Repl. by ABAZOV 09E
<sup>1</sup> Measured the angular and lifetime parameters for the time-dependent angular untagged decays $B_d^0 \rightarrow J/\psi K^{*0}$ and $B_s^0 \rightarrow J/\psi\phi$ .			
<sup>2</sup> Measured mean life ratio using fully reconstructed decays.			
<sup>3</sup> 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 average in a way similar to  $\Delta\Gamma_{B_S^0}/\Gamma_{B_S^0}$ .

<u>VALUE (<math>10^{-12}</math> s)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.615 ± 0.021 OUR EVALUATION</b>			
<b>1.70 ± 0.04 OUR AVERAGE</b>			
1.700 ± 0.040 ± 0.026	<sup>1</sup> AAIJ	12AN LHCb	$pp$ at 7 TeV
1.70 $^{+0.12}_{-0.11}$ ± 0.03	<sup>1</sup> AALTONEN	11AB CDF	$\rho\bar{p}$ at 1.96 TeV

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

	2	AALTONEN	12D	CDF	$\rho\bar{p}$ at 1.96 TeV
1.613 <sup>+0.123</sup> -0.113	3,4	AALTONEN	08J	CDF	Repl. by AALTONEN 12D
1.58 <sup>+0.39</sup> -0.42	4	ABAZOV	05W	D0	Repl. by ABAZOV 08AM
2.07 <sup>+0.58</sup> -0.46	4	ACOSTA	05	CDF	Repl. by AALTONEN 08J

<sup>1</sup> Measured using a pure  $CP$ -odd final state  $J/\psi f_0(980)$ .

<sup>2</sup> Uses the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays assuming  $CP$ -violating angle  $\beta_s(B^0 \rightarrow J/\psi \phi) = 0.02$ .

<sup>3</sup> Obtained from  $\Delta\Gamma_s$  and  $\Gamma_s$  fit with a correlation of 0.6.

<sup>4</sup> 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 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 average in a way similar to  $\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$ .

VALUE ( $10^{-12}$ s)	DOCUMENT ID	TECN	COMMENT
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**1.428 ± 0.013 OUR EVALUATION**

**1.45 ± 0.04 OUR AVERAGE**

1.440 ± 0.096 ± 0.009	1	AAIJ	12	LHCB	$pp$ at 7 TeV
1.455 ± 0.046 ± 0.006	1	AAIJ	12R	LHCB	$pp$ at 7 TeV

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

	2	AALTONEN	12D	CDF	$\rho\bar{p}$ at 1.96 TeV
1.437 <sup>+0.054</sup> -0.047	3,4	AALTONEN	08J	CDF	Repl. by AALTONEN 12D
1.24 <sup>+0.14</sup> -0.11	4	ABAZOV	05W	D0	Repl. by ABAZOV 08AM
1.05 <sup>+0.16</sup> -0.13	4	ACOSTA	05	CDF	Repl. by AALTONEN 08J
1.27 ± 0.33 ± 0.08	5	BARATE	00K	ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> Measured using decays  $B_s^0 \rightarrow K^+ K^-$ .

<sup>2</sup> Uses the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays and assuming  $CP$ -violating angle  $\beta_s(B^0 \rightarrow J/\psi \phi) = 0.02$ .

<sup>3</sup> Obtained from  $\Delta\Gamma_s$  and  $\Gamma_s$  fit with a correlation of 0.6.

<sup>4</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.

<sup>5</sup> 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  $\Delta\Gamma_{B_s^0}/\Gamma_s$  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.

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.123±0.017 OUR EVALUATION</b>				
		<sup>1</sup> AAIJ	12D LHCb	$pp$ at 7 TeV
		<sup>2</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.090±0.009±0.023		<sup>3</sup> ESEN	13 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
		<sup>4</sup> AALTONEN	12D CDF	$p\bar{p}$ at 1.96 TeV
0.147 <sup>+0.036</sup> <sub>-0.030</sub> <sup>+0.042</sup> <sub>-0.041</sub>		<sup>3</sup> ESEN	10 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
0.116 <sup>+0.09</sup> <sub>-0.10</sub> ±0.010		<sup>5</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
0.24 <sup>+0.28</sup> <sub>-0.38</sub> <sup>+0.03</sup> <sub>-0.04</sub>		<sup>5,6</sup> ABAZOV	05W D0	Repl. by ABAZOV 08AM
0.65 <sup>+0.25</sup> <sub>-0.33</sub> ±0.01		<sup>5</sup> ACOSTA	05 CDF	Repl. by AALTONEN 08J
<0.46	95	<sup>7</sup> ABREU	00Y DLPH	$e^+e^- \rightarrow Z$
<0.69	95	<sup>8</sup> ABREU,P	00G DLPH	$e^+e^- \rightarrow Z$
<0.83	95	<sup>9</sup> ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
<0.67	95	<sup>10</sup> ACCIARRI	98S L3	$e^+e^- \rightarrow Z$
<sup>1</sup> Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.				
<sup>2</sup> Measured using fully reconstructed $B_s \rightarrow J/\psi\phi$ decays.				
<sup>3</sup> Assumes $CP$ violation is negligible.				
<sup>4</sup> Uses the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays and assuming $CP$ -violating angle $\beta_s(B^0 \rightarrow J/\psi\phi) = 0.02$ .				
<sup>5</sup> Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.				
<sup>6</sup> Uses $ A_0 ^2 -  A_{  } ^2 = 0.355 \pm 0.066$ from ACOSTA 05.				
<sup>7</sup> Uses $D_s^- \ell^+$ , and $\phi\ell^+$ vertices.				
<sup>8</sup> Measured using $D_s$ hadron vertices.				
<sup>9</sup> ABE 99D assumes $\tau_{B_s^0} = 1.55 \pm 0.05$ ps.				
<sup>10</sup> 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 average in a way similar to  $\Delta\Gamma_{B_s^0}/\Gamma_{B_s^0}$ .

<u>VALUE (<math>10^{12} s^{-1}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.081±0.011 OUR EVALUATION</b>			
<b>0.080±0.020 OUR AVERAGE</b> Error includes scale factor of 1.3. See the ideogram below.			
0.053±0.021±0.010	<sup>1</sup> AAD	12CV ATLAS	$pp$ at 7 TeV
0.123±0.029±0.011	<sup>1</sup> AAIJ	12D LHCb	$pp$ at 7 TeV

$0.068 \pm 0.026 \pm 0.007$	<sup>1</sup> AALTONEN	12AJ CDF	$\rho\bar{\rho}$ at 1.96 TeV
$0.163^{+0.065}_{-0.064}$	<sup>2,3</sup> ABAZOV	12D D0	$\rho\bar{\rho}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.075 \pm 0.035 \pm 0.006$	<sup>4</sup> AALTONEN	12D CDF	Repl. by AALTONEN 12AJ
$0.085^{+0.072}_{-0.078} \pm 0.001$	<sup>5</sup> ABAZOV	09E D0	Repl. by ABAZOV 08AM
$0.076^{+0.059}_{-0.063} \pm 0.006$	<sup>6</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
$0.19 \pm 0.07^{+0.02}_{-0.01}$	<sup>3,7</sup> ABAZOV	08AMD0	Repl. by ABAZOV 12D
$0.12^{+0.08}_{-0.10} \pm 0.02$	<sup>6,8</sup> ABAZOV	07 D0	Repl. by ABAZOV 07N
$0.13 \pm 0.09$	<sup>9</sup> ABAZOV	07N D0	Repl. by ABAZOV 09E
$0.47^{+0.19}_{-0.24} \pm 0.01$	<sup>6</sup> ACOSTA	05 CDF	Repl. by AALTONEN 08J

<sup>1</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>2</sup> The error includes both statistical and systematic uncertainties.

<sup>3</sup> Measured using fully reconstructed  $B_s \rightarrow J/\psi\phi$  decays.

<sup>4</sup> Uses the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays and assuming  $CP$ -violating angle  $\beta_s(B^0 \rightarrow J/\psi\phi) = 0.02$ .

<sup>5</sup> Measured the angular and lifetime parameters for the time-dependent angular untagged decays  $B_d^0 \rightarrow J/\psi K^{*0}$  and  $B_s^0 \rightarrow J/\psi\phi$ .

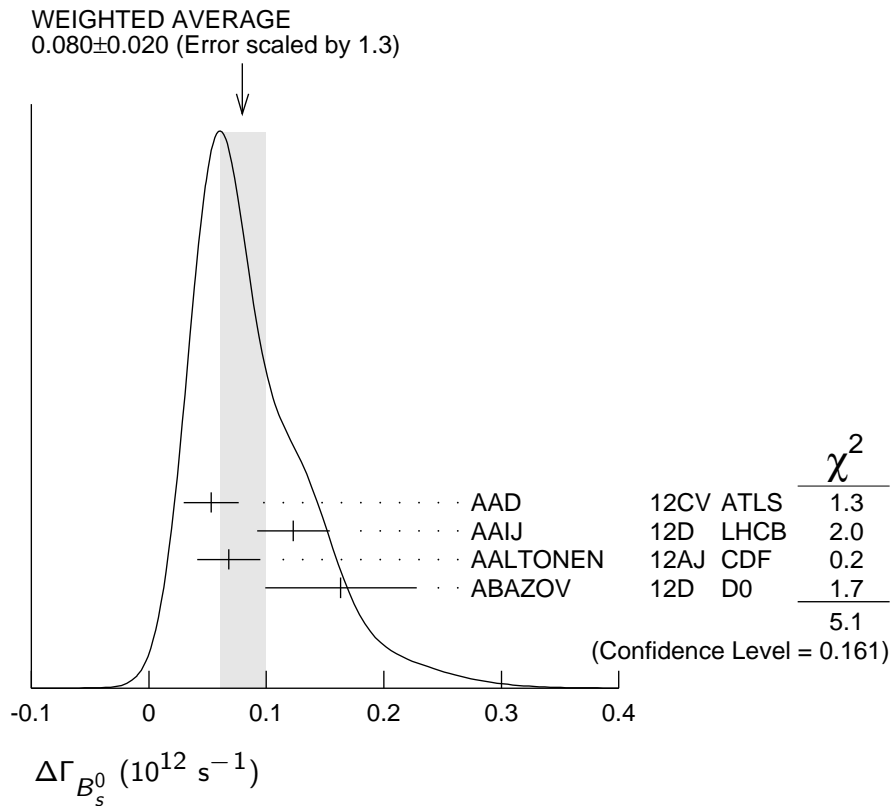
<sup>6</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays and assuming  $CP$ -violating phase  $\phi_s = 0$ .

<sup>7</sup> Obtains 90% CL interval  $-0.06 < \Delta\Gamma_s < 0.30$ .

<sup>8</sup> ABAZOV 07 reports  $0.17 \pm 0.09 \pm 0.02$  with  $CP$ -violating phase  $\phi_s$  as a free parameter.

<sup>9</sup> 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.





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

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.072 \pm 0.021 \pm 0.022$		1 ABAZOV	09I D0	$\rho\bar{\rho}$ at 1.96 TeV
$>0.012$	95	1 AALTONEN	08F CDF	$\rho\bar{\rho}$ at 1.96 TeV
$0.079^{+0.038+0.031}_{-0.035-0.030}$		1 ABAZOV	07Y D0	Repl. by ABAZOV 09I
$0.25^{+0.21}_{-0.14}$		2 BARATE	00K ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> Assumes  $2 \text{ B}(B_s^0 \rightarrow D_s^{(*)} D_s^{(*)}) \simeq \Delta\Gamma_s^{CP} / \Gamma_s$ .

<sup>2</sup> 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 average in a way similar to  $\Delta\Gamma_{B_s^0} / \Gamma_{B_s^0}$ .

<u>VALUE (<math>10^{-12}</math> s)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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**1.516±0.011 OUR EVALUATION**

**1.497±0.017 OUR AVERAGE** Error includes scale factor of 1.4. See the ideogram below.

1.477±0.015±0.009	<sup>1</sup> AAD	12CV ATLS	$p\bar{p}$ at 7 TeV
1.522±0.021±0.019	<sup>2</sup> AAIJ	12D LHCb	$p\bar{p}$ at 7 TeV
1.528±0.019±0.009	<sup>3</sup> AALTONEN	12AJ CDF	$p\bar{p}$ at 1.96 TeV
1.443 <sup>+0.038</sup> <sub>-0.035</sub>	<sup>3,4</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV

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

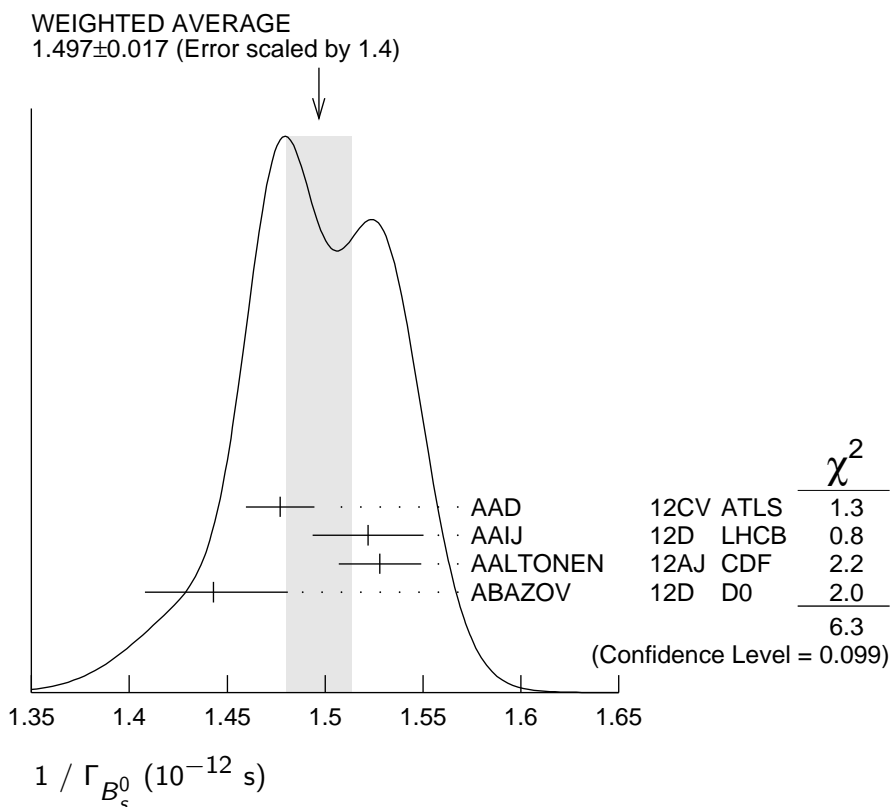
1.529±0.025±0.012	<sup>3</sup> AALTONEN	12D CDF	Repl. by AALTONEN 12AJ
1.487±0.060±0.028	<sup>3</sup> ABAZOV	09E D0	Repl. by ABAZOV 08AM
1.52 ±0.04 ±0.02	<sup>3</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
1.52 ±0.05 ±0.01	<sup>3</sup> ABAZOV	08AMD0	Repl. by ABAZOV 12D

<sup>1</sup> AAD 12CV reports  $\Gamma_{B_s^0} = 0.677 \pm 0.007 \pm 0.004 \text{ ps}^{-1}$  measured using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>2</sup> AAIJ 12D reports average decay width of  $B_s^0$ ,  $\Gamma_{B_s^0} = 0.657 \pm 0.009 \pm 0.008 \text{ ps}^{-1}$  that we converted to  $1/\Gamma_{B_s^0}$ .

<sup>3</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>4</sup> The error includes both statistical and systematic uncertainties.



## $B_s^0$ DECAY MODES

These branching fractions all scale with  $B(\bar{b} \rightarrow B_s^0)$ .

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 ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level
$\Gamma_1$ $D_s^-$ anything	(93 ± 25) %	
$\Gamma_2$ $\ell \nu_\ell X$	( 9.5 ± 2.7 ) %	
$\Gamma_3$ $D_s^- \ell^+ \nu_\ell$ anything	[a] ( 7.9 ± 2.4 ) %	
$\Gamma_4$ $D_{s1}(2536)^- \mu^+ \nu_\mu$ , $D_{s1}^- \rightarrow D^{*-} K_S^0$	( 2.6 ± 0.7 ) × 10 <sup>-3</sup>	
$\Gamma_5$ $D_{s1}(2536)^- X \mu^+ \nu$ , $D_{s1}^- \rightarrow \bar{D}^0 K^+$	( 4.3 ± 1.7 ) × 10 <sup>-3</sup>	
$\Gamma_6$ $D_{s2}(2573)^- X \mu^+ \nu$ , $D_{s2}^- \rightarrow \bar{D}^0 K^+$	( 2.6 ± 1.2 ) × 10 <sup>-3</sup>	
$\Gamma_7$ $D_s^- \pi^+$	( 3.04 ± 0.23 ) × 10 <sup>-3</sup>	
$\Gamma_8$ $D_s^- \rho^+$	( 7.0 ± 1.5 ) × 10 <sup>-3</sup>	
$\Gamma_9$ $D_s^- \pi^+ \pi^+ \pi^-$	( 6.3 ± 1.1 ) × 10 <sup>-3</sup>	
$\Gamma_{10}$ $D_{s1}(2536)^- \pi^+$ , $D_{s1}^- \rightarrow D_s^- \pi^+ \pi^-$	( 2.5 ± 0.8 ) × 10 <sup>-5</sup>	
$\Gamma_{11}$ $D_s^\mp K^\pm$	( 2.03 ± 0.28 ) × 10 <sup>-4</sup>	S=1.3
$\Gamma_{12}$ $D_s^- K^+ \pi^+ \pi^-$	( 3.3 ± 0.7 ) × 10 <sup>-4</sup>	
$\Gamma_{13}$ $D_s^+ D_s^-$	( 5.3 ± 0.8 ) × 10 <sup>-3</sup>	
$\Gamma_{14}$ $D_s^{*-} \pi^+$	( 2.0 ± 0.5 ) × 10 <sup>-3</sup>	
$\Gamma_{15}$ $D_s^{*-} \rho^+$	( 9.7 ± 2.2 ) × 10 <sup>-3</sup>	
$\Gamma_{16}$ $D_s^{*+} D_s^- + D_s^{*-} D_s^+$	( 1.30 ± 0.22 ) %	S=1.1
$\Gamma_{17}$ $D_s^{*+} D_s^{*-}$	( 1.87 ± 0.30 ) %	
$\Gamma_{18}$ $D_s^{(*)+} D_s^{(*)-}$	( 4.5 ± 1.4 ) %	
$\Gamma_{19}$ $\bar{D}^0 \bar{K}^*(892)^0$	( 4.7 ± 1.4 ) × 10 <sup>-4</sup>	
$\Gamma_{20}$ $\bar{D}^0 K^+ K^-$	( 4.2 ± 1.9 ) × 10 <sup>-5</sup>	
$\Gamma_{21}$ $J/\psi(1S) \phi$	(10.0 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 3.2 \\ 1.8 \end{smallmatrix}$ ) × 10 <sup>-4</sup>	
$\Gamma_{22}$ $J/\psi(1S) \pi^0$	< 1.2 × 10 <sup>-3</sup>	CL=90%
$\Gamma_{23}$ $J/\psi(1S) \eta$	( 4.0 ± 0.7 ) × 10 <sup>-4</sup>	S=1.3

$\Gamma_{24}$	$J/\psi(1S)K_S^0$		$(2.1 \pm 0.6) \times 10^{-5}$	S=2.1
$\Gamma_{25}$	$J/\psi(1S)K^*(892)^0$		$(4.4 \pm 0.9) \times 10^{-5}$	
$\Gamma_{26}$	$J/\psi(1S)\eta'$		$(3.4 \pm 0.5) \times 10^{-4}$	
$\Gamma_{27}$	$J/\psi(1S)\pi^+\pi^-$		$(2.0 \pm_{-0.4}^{+0.6}) \times 10^{-4}$	
$\Gamma_{28}$	$J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-$		$(1.29 \pm_{-0.23}^{+0.40}) \times 10^{-4}$	
$\Gamma_{29}$	$J/\psi(1S)f_0(1370), f_0 \rightarrow \pi^+\pi^-$		$(3.9 \pm_{-1.7}^{+0.9}) \times 10^{-5}$	
$\Gamma_{30}$	$J/\psi(1S)f_2(1270), f_2 \rightarrow \pi^+\pi^-$		$(10 \pm_{-4}^{+5}) \times 10^{-7}$	
$\Gamma_{31}$	$J/\psi(1S)\pi^+\pi^-$ (nonresonant)		$(1.7 \pm_{-0.4}^{+1.1}) \times 10^{-5}$	
$\Gamma_{32}$	$J/\psi(1S)f_2'(1525)$		$(2.6 \pm_{-0.6}^{+0.9}) \times 10^{-4}$	
$\Gamma_{33}$	$\psi(2S)f_2'(1525)$		$(2.1 \pm_{-0.8}^{+1.0}) \times 10^{-4}$	
$\Gamma_{34}$	$\psi(2S)\phi$		$(5.0 \pm_{-1.0}^{+1.6}) \times 10^{-4}$	
$\Gamma_{35}$	$\pi^+\pi^-$		$(7.6 \pm 1.9) \times 10^{-7}$	S=1.4
$\Gamma_{36}$	$\pi^0\pi^0$		$< 2.1 \times 10^{-4}$	CL=90%
$\Gamma_{37}$	$\eta\pi^0$		$< 1.0 \times 10^{-3}$	CL=90%
$\Gamma_{38}$	$\eta\eta$		$< 1.5 \times 10^{-3}$	CL=90%
$\Gamma_{39}$	$\rho^0\rho^0$		$< 3.20 \times 10^{-4}$	CL=90%
$\Gamma_{40}$	$\phi\rho^0$		$< 6.17 \times 10^{-4}$	CL=90%
$\Gamma_{41}$	$\phi\phi$		$(1.8 \pm_{-0.4}^{+0.6}) \times 10^{-5}$	
$\Gamma_{42}$	$\pi^+K^-$		$(5.5 \pm 0.6) \times 10^{-6}$	
$\Gamma_{43}$	$K^+K^-$		$(2.52 \pm 0.17) \times 10^{-5}$	
$\Gamma_{44}$	$K^0\bar{K}^0$		$< 6.6 \times 10^{-5}$	CL=90%
$\Gamma_{45}$	$\bar{K}^*(892)^0\rho^0$		$< 7.67 \times 10^{-4}$	CL=90%
$\Gamma_{46}$	$\bar{K}^*(892)^0K^*(892)^0$		$(2.8 \pm 0.7) \times 10^{-5}$	
$\Gamma_{47}$	$\phi K^*(892)^0$		$< 1.013 \times 10^{-3}$	CL=90%
$\Gamma_{48}$	$\rho\bar{\rho}$		$< 5.9 \times 10^{-5}$	CL=90%
$\Gamma_{49}$	$\gamma\gamma$	<i>B1</i>	$< 8.7 \times 10^{-6}$	CL=90%
$\Gamma_{50}$	$\phi\gamma$		$(3.6 \pm 0.4) \times 10^{-5}$	

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

$\Gamma_{51}$	$\mu^+\mu^-$	<i>B1</i>	$(3.2 \pm_{-1.2}^{+1.5}) \times 10^{-9}$	
$\Gamma_{52}$	$e^+e^-$	<i>B1</i>	$< 2.8 \times 10^{-7}$	CL=90%
$\Gamma_{53}$	$e^\pm\mu^\mp$	<i>LF</i> [b]	$< 2.0 \times 10^{-7}$	CL=90%
$\Gamma_{54}$	$\phi(1020)\mu^+\mu^-$	<i>B1</i>	$(1.13 \pm_{-0.29}^{+0.40}) \times 10^{-6}$	
$\Gamma_{55}$	$\phi\nu\bar{\nu}$	<i>B1</i>	$< 5.4 \times 10^{-3}$	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.

### CONSTRAINED FIT INFORMATION

An overall fit to 10 branching ratios uses 16 measurements and one constraint to determine 7 parameters. The overall fit has a  $\chi^2 = 5.0$  for 10 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients  $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$ , in percent, from the fit to the branching fractions,  $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$ . The fit constrains the  $x_i$  whose labels appear in this array to sum to one.

$x_9$	28				
$x_{11}$	55	16			
$x_{21}$	0	0	0		
$x_{28}$	0	0	0	96	
$x_{29}$	0	0	0	52	50
	$x_7$	$x_9$	$x_{11}$	$x_{21}$	$x_{28}$

### $B_s^0$ BRANCHING RATIOS

$\Gamma(D_s^- \text{ anything}) / \Gamma_{\text{total}}$   $\Gamma_1 / \Gamma$

<u>VALUE</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.93 ± 0.25 OUR AVERAGE</b>				
0.91 ± 0.18 ± 0.41		<sup>1</sup> DRUTSKOY 07	BELL	$e^+ e^- \rightarrow \Upsilon(4S)$
0.81 ± 0.24 ± 0.22	90	<sup>2</sup> BUSKULIC 96E	ALEP	$e^+ e^- \rightarrow Z$
1.56 ± 0.58 ± 0.44	147	<sup>3</sup> ACTON 92N	OPAL	$e^+ e^- \rightarrow Z$

<sup>1</sup> The extraction of this result takes into account the correlation between the measurements of  $B(\Upsilon(5S) \rightarrow D_s X)$  and  $B(\Upsilon(5S) \rightarrow D^0 X)$ .

<sup>2</sup> 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  $B(D_s^- \rightarrow \phi\pi)$ .

<sup>3</sup> ACTON 92N assume that excess of  $147 \pm 48 D_s^0$  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  $B(D_s^- \rightarrow \phi\pi)$ .

$\Gamma(\ell\nu_\ell X)/\Gamma_{\text{total}}$				$\Gamma_2/\Gamma$
VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT	
$9.5^{+2.5+1.1}_{-2.0-1.9}$	<sup>1</sup> LEES	12A	BABR	$e^+e^-$

<sup>1</sup> The measurement corresponds to a branching fraction where the lepton originates from bottom decay and is the average between the electron and muon branching fractions. LEES 12A uses the correlation of the production of  $\phi$  mesons in association with a lepton in  $e^+e^-$  data taken at center-of-mass energies between 10.54 and 11.2 GeV.

$\Gamma(D_s^- \ell^+ \nu_\ell \text{anything})/\Gamma_{\text{total}}$				$\Gamma_3/\Gamma$
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
<b>0.079 ± 0.024 OUR AVERAGE</b>				
$0.076 \pm 0.012 \pm 0.021$	134	<sup>1</sup> BUSKULIC	95O	ALEP $e^+e^- \rightarrow Z$
$0.107 \pm 0.043 \pm 0.029$		<sup>2</sup> ABREU	92M	DLPH $e^+e^- \rightarrow Z$
$0.103 \pm 0.036 \pm 0.028$	18	<sup>3</sup> ACTON	92N	OPAL $e^+e^- \rightarrow Z$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.13 \pm 0.04 \pm 0.04$	27	<sup>4</sup> BUSKULIC	92E	ALEP $e^+e^- \rightarrow Z$

<sup>1</sup> 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  $B(D_s \rightarrow \phi\pi)$ .

<sup>2</sup> 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  $B(Z \rightarrow b \text{ or } \bar{b}) = 2B(Z \rightarrow b\bar{b}) = 2 \times (0.2212 \pm 0.0019)$ .

<sup>3</sup> 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  $B(D_s \rightarrow \phi\pi)$ .

<sup>4</sup> 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.

$\Gamma(D_{s1}(2536)^- \mu^+ \nu_\mu, D_{s1}^- \rightarrow D^{*-} K_S^0)/\Gamma_{\text{total}}$   $\Gamma_4/\Gamma$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.6±0.7±0.1</b>	<sup>1</sup> ABAZOV	09G D0	$p\bar{p}$ at 1.96 TeV

<sup>1</sup> ABAZOV 09G reports  $[\Gamma(B_S^0 \rightarrow D_{s1}(2536)^- \mu^+ \nu_\mu, D_{s1}^- \rightarrow D^{*-} K_S^0)/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow B_S^0)] = (2.66 \pm 0.52 \pm 0.45) \times 10^{-4}$  which we divide by our best value  $B(\bar{b} \rightarrow B_S^0) = (10.4 \pm 0.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+)/\Gamma(D_S^- \ell^+ \nu_\ell \text{ anything})$   $\Gamma_5/\Gamma_3$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>5.4±1.2±0.5</b>	AAIJ	11A LHCB	$pp$ at 7 TeV

$\Gamma(D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+)/\Gamma(D_S^- \ell^+ \nu_\ell \text{ anything})$   $\Gamma_6/\Gamma_3$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>3.3±1.0±0.4</b>	AAIJ	11A LHCB	$pp$ at 7 TeV

$\Gamma(D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+)/\Gamma(D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+)$   $\Gamma_5/\Gamma_6$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.61±0.14±0.05	<sup>1</sup> AAIJ	11A LHCB	$pp$ at 7 TeV
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<sup>1</sup> Not independent of other AAIJ 11A measurements.

$\Gamma(D_S^- \pi^+)/\Gamma_{\text{total}}$   $\Gamma_7/\Gamma$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
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**3.04±0.23 OUR FIT**  
**3.02±0.24 OUR AVERAGE**

2.95 ± 0.05 <sup>+0.25</sup> <sub>-0.28</sub>	<sup>1</sup> AAIJ	12AG LHCB	$pp$ at 7 TeV
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3.6 ± 0.5 ± 0.5	<sup>2</sup> LOUVOT	09 BELL	$e^+ e^- \rightarrow \gamma(5S)$
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3.0 ± 0.7 ± 0.1	<sup>3</sup> ABULENCIA	07C CDF	$p\bar{p}$ at 1.96 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

6.8 ± 2.2 ± 1.6	DRUTSKOY	07A BELL	Repl. by LOUVOT 09
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3.5 ± 1.1 ± 0.2	<sup>4</sup> ABULENCIA	06J CDF	Repl. by ABULENCIA 07C
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<130	<sup>6</sup>	<sup>5</sup> AKERS	94J OPAL	$e^+ e^- \rightarrow Z$
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seen	<sup>1</sup>	BUSKULIC	93G ALEP	$e^+ e^- \rightarrow Z$
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<sup>1</sup> AAIJ 12AG reports  $(2.95 \pm 0.05 \pm 0.17^{+0.18}_{-0.22}) \times 10^{-3}$  where the last uncertainty comes from the semileptonic  $f_s/f_d$  measurement. We combined the systematics in quadrature.

<sup>2</sup> 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  $B(\gamma(10860) \rightarrow B_S^{(*)} \bar{B}_S^{(*)}) = (19.9 \pm 3.0) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>3</sup> 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.

<sup>4</sup> 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.

<sup>5</sup> AKERS 94J sees  $\leq 6$  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  $B(\bar{b} \rightarrow B_S^0) = 0.105$ .

### $\Gamma(D_S^- \rho^+)/\Gamma_{\text{total}}$ $\Gamma_8/\Gamma$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>7.0±1.4±0.5</b>	<sup>1</sup> LOUVOT	10	BELL $e^+e^- \rightarrow \gamma(5S)$

<sup>1</sup> LOUVOT 10 reports  $[\Gamma(B_S^0 \rightarrow D_S^- \rho^+)/\Gamma_{\text{total}}] / [B(B_S^0 \rightarrow D_S^- \pi^+)] = 2.3 \pm 0.4 \pm 0.2$  which we multiply by our best value  $B(B_S^0 \rightarrow D_S^- \pi^+) = (3.04 \pm 0.23) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

### $\Gamma(D_S^- \pi^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$ $\Gamma_9/\Gamma$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>6.3±1.1 OUR FIT</b>			
<b>6.7±1.5±0.7</b>	<sup>1</sup> ABULENCIA	07C	CDF $\rho\bar{p}$ at 1.96 TeV

<sup>1</sup> 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  $B(B^0 \rightarrow D^- \pi^+ \pi^+ \pi^-) = (6.4 \pm 0.7) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

### $\Gamma(D_S^- \pi^+ \pi^+ \pi^-)/\Gamma(D_S^- \pi^+)$ $\Gamma_9/\Gamma_7$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>2.08±0.34 OUR FIT</b>			
<b>2.01±0.37±0.20</b>	AAIJ	11E	LHCB $pp$ at 7 TeV

### $\Gamma(D_{s1}(2536)^- \pi^+, D_{s1}^- \rightarrow D_S^- \pi^+ \pi^-)/\Gamma(D_S^- \pi^+ \pi^+ \pi^-)$ $\Gamma_{10}/\Gamma_9$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>4.0±1.0±0.4</b>	AAIJ	12AX	LHCB $pp$ at 7 TeV

### $\Gamma(D_S^\mp K^\pm)/\Gamma_{\text{total}}$ $\Gamma_{11}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.03±0.28 OUR FIT</b>			Error includes scale factor of 1.3.

<b>2.4 <math>^{+1.2}_{-1.0}</math> ±0.4</b>	<sup>1</sup> LOUVOT	09	BELL $e^+e^- \rightarrow \gamma(5S)$
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<sup>1</sup> 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  $B(\gamma(10860) \rightarrow B_S^{(*)} \bar{B}_S^{(*)}) = (19.9 \pm 3.0) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.



$\Gamma(D_s^\mp K^\pm)/\Gamma(D_s^- \pi^+)$   $\Gamma_{11}/\Gamma_7$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.067 ± 0.008 OUR FIT</b>			Error includes scale factor of 1.6.
<b>0.066 ± 0.008 OUR AVERAGE</b>			Error includes scale factor of 1.6.
0.0646 ± 0.0043 ± 0.0025	AAIJ	12AG LHCb	$pp$ at 7 TeV
0.097 ± 0.018 ± 0.009	AALTONEN	09AQ CDF	$p\bar{p}$ at 1.96 TeV

$\Gamma(D_s^- K^+ \pi^+ \pi^-)/\Gamma(D_s^- \pi^+ \pi^+ \pi^-)$   $\Gamma_{12}/\Gamma_9$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>5.2 ± 0.5 ± 0.3</b>	AAIJ	12AX LHCb	$pp$ at 7 TeV

$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$   $\Gamma_{13}/\Gamma$

VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>5.3 ± 0.8 OUR AVERAGE</b>				
$5.8^{+1.1}_{-0.9} \pm 1.3$		<sup>1</sup> ESEN	13 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$
$5.1 \pm 0.8 \pm 0.6$		<sup>2</sup> AALTONEN	12C CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$10.3^{+3.9+2.6}_{-3.2-2.5}$		<sup>3</sup> ESEN	10 BELL	Repl. by ESEN 13
$10.4^{+3.5}_{-3.2} \pm 1.1$		<sup>4</sup> AALTONEN	08F CDF	Repl. by AALTONEN 12C
<67	90	DRUTSKOY	07A BELL	Repl. by ESEN 10

<sup>1</sup> Use  $\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*$  decays assuming  $B(\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*) = (17.1 \pm 3.0)\%$  and  $\Gamma(\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(5S) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (87.0 \pm 1.7)\%$ .

<sup>2</sup> AALTONEN 12C reports  $(f_s/f_d) (B(B_s^0 \rightarrow D_s^+ D_s^-) / B(B^0 \rightarrow D^- D_s^+)) = 0.183 \pm 0.021 \pm 0.017$ . We multiply this result by our best value of  $B(B^0 \rightarrow D^- D_s^+) = (7.2 \pm 0.8) \times 10^{-3}$  and divide by our best value of  $f_s/f_d$ , where  $1/2 f_s/f_d = 0.129 \pm 0.008$ . Our first quoted uncertainty is the combined experiment's uncertainty and our second is the systematic uncertainty from using our best values.

<sup>3</sup> Uses  $\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*$  assuming  $B(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.3 \pm 2.9)\%$  and  $\Gamma(\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

<sup>4</sup> 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.

$\Gamma(D_s^{*-} \pi^+)/\Gamma_{\text{total}}$   $\Gamma_{14}/\Gamma$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.0<sup>+0.5+0.1</sup><sub>-0.4-0.2</sub></b>	<sup>1</sup> LOUVOT	10 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$

<sup>1</sup> LOUVOT 10 reports  $[\Gamma(B_s^0 \rightarrow D_s^{*-} \pi^+)/\Gamma_{\text{total}}] / [B(B_s^0 \rightarrow D_s^- \pi^+)] = 0.65^{+0.15}_{-0.13} \pm 0.07$  which we multiply by our best value  $B(B_s^0 \rightarrow D_s^- \pi^+) = (3.04 \pm 0.23) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^{*-} \rho^+)/\Gamma_{\text{total}}$				$\Gamma_{15}/\Gamma$
VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT	
$9.7 \pm 2.0^{+0.7}_{-0.8}$	<sup>1</sup> LOUVOT	10	BELL $e^+ e^- \rightarrow \gamma(5S)$	

<sup>1</sup> LOUVOT 10 reports  $[\Gamma(B_s^0 \rightarrow D_s^{*-} \rho^+)/\Gamma_{\text{total}}] / [B(B_s^0 \rightarrow D_s^- \pi^+)] = 3.2 \pm 0.6 \pm 0.3$  which we multiply by our best value  $B(B_s^0 \rightarrow D_s^- \pi^+) = (3.04 \pm 0.23) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^{*-} \rho^+)/\Gamma(D_s^- \rho^+)$				$\Gamma_{15}/\Gamma_8$
VALUE	DOCUMENT ID	TECN	COMMENT	
$1.4 \pm 0.3 \pm 0.1$	LOUVOT	10	BELL $e^+ e^- \rightarrow \gamma(5S)$	

$[\Gamma(D_s^{*+} D_s^-) + \Gamma(D_s^{*-} D_s^+)]/\Gamma_{\text{total}}$				$\Gamma_{16}/\Gamma$
VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>13.0 \pm 2.2</math> OUR AVERAGE</b>		Error includes scale factor of 1.1.		
$17.6^{+2.3}_{-2.2} \pm 4.0$		<sup>1</sup> ESEN	13	BELL $e^+ e^- \rightarrow \gamma(5S)$
$11.9 \pm 1.6 \pm 1.5$		<sup>2</sup> AALTONEN	12C	CDF $p\bar{p}$ at 1.96 TeV
$27.5^{+8.3}_{-7.1} \pm 6.9$		<sup>3</sup> ESEN	10	BELL Repl. by ESEN 13
<121	90	DRUTSKOY	07A	BELL Repl. by ESEN 10

<sup>1</sup> Use  $\gamma(5S) \rightarrow B_s^* \bar{B}_s^*$  decays assuming  $B(\gamma(5S) \rightarrow B_s^* \bar{B}_s^*) = (17.1 \pm 3.0)\%$  and  $\Gamma(\gamma(5S) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\gamma(5S) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (87.0 \pm 1.7)\%$ .

<sup>2</sup> AALTONEN 12C reports  $(f_s/f_d) (B(B_s^0 \rightarrow D_s^{*+} D_s^- + D_s^{*-} D_s^+) / B(B^0 \rightarrow D^- D_s^+)) = 0.424 \pm 0.046 \pm 0.035$ . We multiply this result by our best value of  $B(B^0 \rightarrow D^- D_s^+) = (7.2 \pm 0.8) \times 10^{-3}$  and divide by our best value of  $f_s/f_d$ , where  $1/2 f_s/f_d = 0.129 \pm 0.008$ . Our first quoted uncertainty is the combined experiment's uncertainty and our second is the systematic uncertainty from using our best values.

<sup>3</sup> Uses  $\gamma(10860) \rightarrow B_s^* \bar{B}_s^*$  assuming  $B(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.3 \pm 2.9)\%$  and  $\Gamma(\gamma(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

$\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$				$\Gamma_{17}/\Gamma$
VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>18.7 \pm 3.0</math> OUR AVERAGE</b>				
$19.8^{+3.3+5.2}_{-3.1-5.0}$		<sup>1</sup> ESEN	13	BELL $e^+ e^- \rightarrow \gamma(5S)$
$18.3 \pm 2.7 \pm 2.3$		<sup>2</sup> AALTONEN	12C	CDF $p\bar{p}$ at 1.96 TeV
$30.8^{+12.2+8.5}_{-10.4-8.6}$		<sup>3</sup> ESEN	10	BELL Repl. by ESEN 13
<257	90	DRUTSKOY	07A	BELL Repl. by ESEN 10

- <sup>1</sup> Use  $\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*$  decays assuming  $B(\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*) = (17.1 \pm 3.0)\%$  and  $\Gamma(\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(5S) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (87.0 \pm 1.7)\%$ .
- <sup>2</sup> AALTONEN 12C reports  $(f_s/f_d) (B(B_s^0 \rightarrow D_s^{*+} D_s^{*-}) / B(B^0 \rightarrow D^- D_s^+)) = 0.654 \pm 0.072 \pm 0.065$ . We multiply this result by our best value of  $B(B^0 \rightarrow D^- D_s^+) = (7.2 \pm 0.8) \times 10^{-3}$  and divide by our best value of  $f_s/f_d$ , where  $1/2 f_s/f_d = 0.129 \pm 0.008$ . Our first quoted uncertainty is the combined experiment's uncertainty and our second is the systematic uncertainty from using our best values.
- <sup>3</sup> Uses  $\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*$  assuming  $B(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.3 \pm 2.9)\%$  and  $\Gamma(\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

$\Gamma(D_s^{(*)+} D_s^{(*)-}) / \Gamma_{\text{total}}$   $\Gamma_{18} / \Gamma$

“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 (%)	CL%	DOCUMENT ID	TECN	COMMENT
<b>4.5 ± 1.4 OUR EVALUATION</b>				
<b>3.7 ± 0.5 OUR AVERAGE</b>				
4.32 <sup>+0.42+1.04</sup> <sub>-0.39-1.03</sub>		<sup>1</sup> ESEN	13 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$
3.5 ± 0.4 ± 0.4		<sup>2</sup> AALTONEN	12C CDF	$p\bar{p}$ at 1.96 TeV
3.5 ± 1.0 ± 1.1		<sup>3</sup> ABAZOV	09I D0	$p\bar{p}$ at 1.96 TeV
14 ± 6 ± 3		<sup>4,5</sup> BARATE	00K ALEP	$e^+ e^- \rightarrow Z$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
6.85 <sup>+1.53+1.79</sup> <sub>-1.30-1.80</sub>		<sup>6,7</sup> ESEN	10 BELL	Repl. by ESEN 13
3.9 <sup>+1.9+1.6</sup> <sub>-1.7-1.5</sub>		<sup>3</sup> ABAZOV	07Y D0	Repl. by ABAZOV 09I
<0.218	90	BARATE	98Q ALEP	$e^+ e^- \rightarrow Z$

- <sup>1</sup> Use  $\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*$  decays assuming  $B(\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*) = (17.1 \pm 3.0)\%$  and  $\Gamma(\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(5S) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (87.0 \pm 1.7)\%$ .
- <sup>2</sup> AALTONEN 12C reports  $(f_s/f_d) (B(B_s^0 \rightarrow D_s^{(*)+} D_s^{(*)-}) / B(B^0 \rightarrow D^- D_s^+)) = 1.261 \pm 0.095 \pm 0.112$ . We multiply this result by our best value of  $B(B^0 \rightarrow D^- D_s^+) = (7.2 \pm 0.8) \times 10^{-3}$  and divide by our best value of  $f_s/f_d$ , where  $1/2 f_s/f_d = 0.129 \pm 0.008$ . Our first quoted uncertainty is the combined experiment's uncertainty and our second is the systematic uncertainty from using our best values.
- <sup>3</sup> Uses the final states where  $D_s^+ \rightarrow \phi \pi^+$  and  $D_s^- \rightarrow \phi \mu^- \bar{\nu}_\mu$ .
- <sup>4</sup> 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.
- <sup>5</sup> Uses  $\phi\phi$  correlations from  $B_s^0(\text{short}) \rightarrow D_s^{(*)+} D_s^{(*)-}$ .
- <sup>6</sup> Sum of exclusive  $B_s \rightarrow D_s^+ D_s^-$ ,  $B_s \rightarrow D_s^{*\pm} D_s^\mp$  and  $B_s \rightarrow D_s^{*+} D_s^{*-}$ .
- <sup>7</sup> Uses  $\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*$  assuming  $B(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.3 \pm 2.9)\%$  and  $\Gamma(\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

$\Gamma(\overline{D}^0 \overline{K}^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{19}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>4.7 \pm 1.2 \pm 0.7</math></b>	<sup>1</sup> AAIJ	11D LHCB	$p\bar{p}$ at 7 TeV

<sup>1</sup> AAIJ 11D reports  $[\Gamma(B_s^0 \rightarrow \overline{D}^0 \overline{K}^*(892)^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \overline{D}^0 \rho^0)] = 1.48 \pm 0.34 \pm 0.19$  which we multiply by our best value  $B(B^0 \rightarrow \overline{D}^0 \rho^0) = (3.2 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\overline{D}^0 K^+ K^-)/\Gamma_{\text{total}}$   $\Gamma_{20}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>4.2 \pm 1.6 \pm 1.1</math></b>	<sup>1,2</sup> AAIJ	12AMLHCB	$p\bar{p}$ at 7 TeV

<sup>1</sup> AAIJ 12AM reports  $[\Gamma(B_s^0 \rightarrow \overline{D}^0 K^+ K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \overline{D}^0 K^+ K^-)] = 0.90 \pm 0.27 \pm 0.20$  which we multiply by our best value  $B(B^0 \rightarrow \overline{D}^0 K^+ K^-) = (4.7 \pm 1.2) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> Uses  $B(b \rightarrow B_s^0)/B(b \rightarrow B^0) = 0.267^{+0.023}_{-0.020}$  measured by the same authors.

$\Gamma(J/\psi(1S)\phi)/\Gamma_{\text{total}}$   $\Gamma_{21}/\Gamma$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
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**$1.00^{+0.32}_{-0.18}$  OUR FIT**

**$1.4 \pm 0.5 \pm 0.1$**  <sup>1</sup> ABE 96Q CDF  $p\bar{p}$

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

<6	1	<sup>2</sup> AKERS	94J OPAL	$e^+ e^- \rightarrow Z$
seen	14	<sup>3</sup> ABE	93F CDF	$p\bar{p}$ at 1.8 TeV
seen	1	<sup>4</sup> ACTON	92N OPAL	Sup. by AKERS 94J

<sup>1</sup> 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  $\Gamma(\bar{b} \rightarrow B_s^0)/[\Gamma(\bar{b} \rightarrow B^+) + \Gamma(\bar{b} \rightarrow B^0)] = 0.129 \pm 0.008$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> 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  $B(\bar{b} \rightarrow B_s^0) = 0.112$ .

<sup>3</sup> ABE 93F measured using  $J/\psi(1S) \rightarrow \mu^+ \mu^-$  and  $\phi \rightarrow K^+ K^-$ .

<sup>4</sup> In ACTON 92N a limit on the product branching fraction is measured to be  $f(\bar{b} \rightarrow B_s^0) \cdot B(B_s^0 \rightarrow J/\psi(1S)\phi) \leq 0.22 \times 10^{-2}$ .

$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{22}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN
<b><math>&lt; 1.2 \times 10^{-3}</math></b>	90	<sup>1</sup> ACCIARRI	97C L3

<sup>1</sup> ACCIARRI 97C assumes  $B^0$  production fraction ( $39.5 \pm 4.0\%$ ) and  $B_s$  ( $12.0 \pm 3.0\%$ ).

$\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$   $\Gamma_{23}/\Gamma$

VALUE (units $10^{-4}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**4.0 ± 0.7 OUR AVERAGE** Error includes scale factor of 1.3.

3.6 <sup>+0.5</sup> <sub>-0.6</sub> ± 0.3		<sup>1</sup> AAIJ	13A	LHCB $pp$ at 7 TeV
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5.10 ± 0.50 <sup>+1.17</sup> <sub>-0.83</sub>		<sup>2</sup> LI	12	BELL $e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<38	90	<sup>3</sup> ACCIARRI	97C	L3
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<sup>1</sup> AAIJ 13A reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)\eta)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)\rho^0)] = 14.0 \pm 1.2_{-1.5}^{+1.1+1.1-1.0}$  which we multiply by our best value  $B(B^0 \rightarrow J/\psi(1S)\rho^0) = (2.58 \pm 0.21) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> Observed for the first time with significances over  $10\sigma$ . The second error are total systematic uncertainties including the error on  $N(B_S^{(*)}\bar{B}_S^{(*)})$ .

<sup>3</sup> ACCIARRI 97C assumes  $B^0$  production fraction ( $39.5 \pm 4.0\%$ ) and  $B_S$  ( $12.0 \pm 3.0\%$ ).

$\Gamma(J/\psi(1S)K_S^0)/\Gamma_{\text{total}}$   $\Gamma_{24}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
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**2.1 ± 0.6 OUR AVERAGE** Error includes scale factor of 2.1.

1.89 ± 0.24 ± 0.14	<sup>1</sup> AAIJ	120	LHCB $pp$ at 7 TeV
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3.7 ± 0.7 ± 0.3	<sup>2</sup> AALTONEN	11A	CDF $p\bar{p}$ at 1.96 TeV
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<sup>1</sup> AAIJ 120 reports  $(1.83 \pm 0.21 \pm 0.10 \pm 0.14 \pm 0.07) \times 10^{-5}$  from a measurement of  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)K_S^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)K^0)] \times [\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0)]$  assuming  $B(B^0 \rightarrow J/\psi(1S)K^0) = (8.71 \pm 0.32) \times 10^{-4}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.267_{-0.02}^{+0.021}$ , which we rescale to our best values  $B(B^0 \rightarrow J/\psi(1S)K^0) = (8.73 \pm 0.32) \times 10^{-4}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.259 \pm 0.016$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup> AALTONEN 11A reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)K_S^0)/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow B_S^0)] / [B(\bar{b} \rightarrow B^0)] / [B(B^0 \rightarrow J/\psi(1S)K^0)] = 0.0109 \pm 0.0019 \pm 0.0011$  which we multiply or divide by our best values  $B(\bar{b} \rightarrow B_S^0) = (10.4 \pm 0.6) \times 10^{-2}$ ,  $B(\bar{b} \rightarrow B^0) = (40.2 \pm 0.7) \times 10^{-2}$ ,  $B(B^0 \rightarrow J/\psi(1S)K^0) = (8.73 \pm 0.32) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(J/\psi(1S)K^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{25}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
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<b>4.4<sup>+0.5</sup><sub>-0.4</sub> ± 0.8</b>	<sup>1</sup> AAIJ	12AP	LHCB $pp$ at 7 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

9 ± 4 ± 1	<sup>2</sup> AALTONEN	11A	CDF $p\bar{p}$ at 1.96 TeV
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<sup>1</sup> AAIJ 12AP reports  $B(B_S^0 \rightarrow J/\psi(1S)K^*(892)^0)/B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (3.43_{-0.36}^{+0.34} \pm 0.50) \times 10^{-2}$  and  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.29 \pm 0.05 \pm 0.13) \times 10^{-3}$  after correcting for the contribution from  $K\pi$  S-wave beneath the  $K^*$  peak.

<sup>2</sup> AALTONEN 11A reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)K^*(892)^0)/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow B_S^0)] / [B(\bar{b} \rightarrow B^0)] / [B(B^0 \rightarrow J/\psi(1S)K^*(892)^0)] = 0.0168 \pm 0.0024 \pm 0.0068$  which we

multiply or divide by our best values  $B(\bar{B} \rightarrow B_S^0) = (10.4 \pm 0.6) \times 10^{-2}$ ,  $B(\bar{B} \rightarrow B^0) = (40.2 \pm 0.7) \times 10^{-2}$ ,  $B(B^0 \rightarrow J/\psi(1S) K^*(892)^0) = (1.34 \pm 0.06) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

**$\Gamma(J/\psi(1S)\eta')/\Gamma_{\text{total}}$   $\Gamma_{26}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3.4 ± 0.5 OUR AVERAGE</b>			
3.3 $^{+0.4}_{-0.5} \pm 0.3$	<sup>1</sup> AAIJ	13A	LHCB $pp$ at 7 TeV
3.71 ± 0.61 $^{+0.85}_{-0.60}$	<sup>2</sup> LI	12	BELL $e^+e^- \rightarrow \Upsilon(4S)$

<sup>1</sup> AAIJ 13A reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)\eta')/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)\rho^0)] = 12.7 \pm 1.1^{+0.5+1.0}_{-1.3-0.9}$  which we multiply by our best value  $B(B^0 \rightarrow J/\psi(1S)\rho^0) = (2.58 \pm 0.21) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> Observed for the first time with significances over  $10\sigma$ . The second error are total systematic uncertainties including the error on  $N(B_S^{(*)}\bar{B}_S^{(*)})$ .

**$\Gamma(J/\psi(1S)\eta')/\Gamma(J/\psi(1S)\eta)$   $\Gamma_{26}/\Gamma_{23}$**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.85 <math>^{+0.09}_{-0.08}</math> OUR AVERAGE</b>			
0.90 ± 0.09 $^{+0.06}_{-0.02}$	<sup>1</sup> AAIJ	13A	LHCB $pp$ at 7 TeV
0.73 ± 0.14 ± 0.02	<sup>1</sup> LI	12	BELL $e^+e^- \rightarrow \Upsilon(4S)$

<sup>1</sup> Strongly correlated with measurements of  $\Gamma(J/\psi(1S)\eta)/\Gamma$  and  $\Gamma(J/\psi(1S)\eta')/\Gamma$  reported in the same reference.

**$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{27}/\Gamma_{21}$**

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>19.8 ± 0.5 ± 0.5</b>	<sup>1</sup> AAIJ	12AO	LHCB $pp$ at 7 TeV

<sup>1</sup> AAIJ 12AO reports  $(19.79 \pm 0.47 \pm 0.52) \times 10^{-2}$  from a measurement of  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)] / [B(\phi(1020) \rightarrow K^+K^-)]$  assuming  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ .

**$\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{28}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.29 <math>^{+0.40}_{-0.23}</math> OUR FIT</b>			
1.16 $^{+0.31+0.30}_{-0.19-0.25}$	<sup>1</sup> LI	11	BELL $e^+e^- \rightarrow \Upsilon(5S)$

<sup>1</sup> The second error includes both the detector systematic and the uncertainty in the number of produced  $Y(5S) \rightarrow B_S^{(*)}\bar{B}_S^{(*)}$  pairs.

$\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{28}/\Gamma_{21}$

VALUE DOCUMENT ID TECN COMMENT

**0.130±0.009 OUR FIT**

**0.130<sup>+0.010</sup><sub>-0.008</sub> OUR AVERAGE**

0.139±0.006 <sup>+0.025</sup> <sub>-0.012</sub>	1,2 AAIJ	12AO LHCb	$pp$ at 7 TeV
0.135±0.036±0.001	3 ABAZOV	12C D0	$p\bar{p}$ at 1.96 TeV
0.123 <sup>+0.026</sup> <sub>-0.022</sub> ±0.001	4 AAIJ	11 LHCb	$pp$ at 7 TeV
0.126±0.012±0.001	5 AALTONEN	11AB CDF	$p\bar{p}$ at 1.96 TeV

<sup>1</sup> AAIJ 12AO reports  $(13.9 \pm 0.6^{+2.5}_{-1.2}) \times 10^{-2}$  from a measurement of  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)] / [B(\phi(1020) \rightarrow K^+K^-)]$  assuming  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ .

<sup>2</sup> Measured in Dalitz plot like analysis of  $B_S \rightarrow J/\psi\pi^+\pi^-$  decays.

<sup>3</sup> ABAZOV 12C reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)] / [B(\phi(1020) \rightarrow K^+K^-)] = 0.275 \pm 0.041 \pm 0.061$  which we multiply by our best value  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>4</sup> AAIJ 11 reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)] / [B(\phi(1020) \rightarrow K^+K^-)] = 0.252^{+0.046+0.027}_{-0.032-0.033}$  which we multiply by our best value  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>5</sup> AALTONEN 11AB reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)] / [B(\phi(1020) \rightarrow K^+K^-)] = 0.257 \pm 0.020 \pm 0.014$  which we multiply by our best value  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(J/\psi(1S)f_0(1370), f_0 \rightarrow \pi^+\pi^-)/\Gamma_{total}$   $\Gamma_{29}/\Gamma$

VALUE (units 10<sup>-4</sup>) DOCUMENT ID TECN COMMENT

**0.39<sup>+0.09</sup><sub>-0.17</sub> OUR FIT**

**0.34<sup>+0.11+0.085</sup><sub>-0.14-0.054</sub>** <sup>1</sup> LI 11 BELL  $e^+e^- \rightarrow \Upsilon(5S)$

<sup>1</sup> The second error includes both the detector systematic and the uncertainty in the number of produced  $Y(5S) \rightarrow B_S^{(*)}\bar{B}_S^{(*)}$  pairs.

$\Gamma(J/\psi(1S)f_0(1370), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{29}/\Gamma_{21}$

VALUE (units 10<sup>-2</sup>) DOCUMENT ID TECN COMMENT

**3.9<sup>+0.6</sup><sub>-2.0</sub> OUR FIT**

**4.2±0.5<sup>+0.1</sup><sub>-3.7</sub>** <sup>1,2</sup> AAIJ 12AO LHCb  $pp$  at 7 TeV

<sup>1</sup> AAIJ 12AO reports  $(4.19 \pm 0.53^{+0.12}_{-3.7}) \times 10^{-2}$  from a measurement of  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)f_0(1370), f_0 \rightarrow \pi^+\pi^-)/\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)] / [B(\phi(1020) \rightarrow K^+K^-)]$  assuming  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ .

<sup>2</sup> Measured in Dalitz plot like analysis of  $B_S \rightarrow J/\psi\pi^+\pi^-$  decays.

**$\Gamma(J/\psi(1S)f_2(1270), f_2 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{30}/\Gamma_{21}$**

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>9.8 \pm 3.3^{+0.6}_{-1.5}</math></b>	1,2 AAIJ	12AO LHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 12AO reports  $(0.098 \pm 0.033^{+0.006}_{-0.015}) \times 10^{-2}$  from a measurement of  $[\Gamma(B_s^0 \rightarrow J/\psi(1S)f_2(1270), f_2 \rightarrow \pi^+\pi^-)/\Gamma(B_s^0 \rightarrow J/\psi(1S)\phi)] / [B(\phi(1020) \rightarrow K^+K^-)]$  assuming  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ .

<sup>2</sup> Measured in Dalitz plot like analysis of  $B_s \rightarrow J/\psi\pi^+\pi^-$  decays for the  $f_2$  helicity state  $\lambda = 0$ .

**$\Gamma(J/\psi(1S)\pi^+\pi^-(\text{nonresonant}))/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{31}/\Gamma_{21}$**

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>1.66 \pm 0.31^{+0.96}_{-0.08}</math></b>	1,2 AAIJ	12AO LHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 12AO reports  $(1.66 \pm 0.31^{+0.96}_{-0.08}) \times 10^{-2}$  from a measurement of  $[\Gamma(B_s^0 \rightarrow J/\psi(1S)\pi^+\pi^-(\text{nonresonant}))/\Gamma(B_s^0 \rightarrow J/\psi(1S)\phi)] / [B(\phi(1020) \rightarrow K^+K^-)]$  assuming  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ .

<sup>2</sup> Measured in Dalitz plot like analysis of  $B_s \rightarrow J/\psi\pi^+\pi^-$  decays.

**$\Gamma(J/\psi(1S)f'_2(1525))/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{32}/\Gamma_{21}$**

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>26.4 \pm 3.5 \pm 0.7</math></b>	<sup>1</sup> AAIJ	12S LHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 12S reports  $[(26.4 \pm 2.7 \pm 2.4) \times 10^{-2}]$  from a measurement of  $\Gamma(B_s^0 \rightarrow J/\psi(1S)f'_2(1525))/\Gamma(B_s^0 \rightarrow J/\psi(1S)\phi) \times B(f'_2(1525) \rightarrow K^+K^-) / B(\phi(1020) \rightarrow K^+K^-)$  assuming  $B(f'_2(1525) \rightarrow K^+K^-) = (44.4 \pm 1.1) \times 10^{-2}$ ,  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ , which we rescale to our best values  $B(f'_2(1525) \rightarrow K^+K^-) = \frac{1}{2}(88.7 \pm 2.2) \times 10^{-2}$ ,  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

**$\Gamma(\psi(2S)f'_2(1525))/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{33}/\Gamma_{21}$**

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.21 \pm 0.07 \pm 0.01</math></b>	1,2 ABAZOV	12AF D0	$p\bar{p}$ at 1.96 TeV

<sup>1</sup> ABAZOV 12AF reports  $[\Gamma(B_s^0 \rightarrow \psi(2S)f'_2(1525))/\Gamma(B_s^0 \rightarrow J/\psi(1S)\phi)] \times B(f'_2(1525) \rightarrow K^+K^-) / B(\phi(1020) \rightarrow K^+K^-) = 0.19 \pm 0.05 \pm 0.04$  which we divide and multiply by our best values  $B(f'_2(1525) \rightarrow K^+K^-) = \frac{1}{2}(88.7 \pm 2.2) \times 10^{-2}$ ,  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup> ABAZOV 12AF fits the invariant masses of the  $K^+K^-$  pair in the range  $1.35 < M(K^+K^-) < 2$  GeV.

**$\Gamma(\psi(2S)\phi)/\Gamma_{\text{total}}$   $\Gamma_{34}/\Gamma$**

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	1	BUSKULIC	93G ALEP	$e^+e^- \rightarrow Z$
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### $\Gamma(\psi(2S)\phi)/\Gamma(J/\psi(1S)\phi)$

$\Gamma_{34}/\Gamma_{21}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.499 ± 0.034 OUR AVERAGE</b>			
0.496 ± 0.034 ± 0.012	<sup>1,2</sup> AAIJ	12L LHCb	$pp$ at 7 TeV
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

<sup>1</sup> AAIJ 12L reports  $0.489 \pm 0.026 \pm 0.021 \pm 0.012$  from a measurement of  $[\Gamma(B_S^0 \rightarrow \psi(2S)\phi)/\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)] \times [B(J/\psi(1S) \rightarrow e^+e^-)] / [B(\psi(2S) \rightarrow e^+e^-)]$  assuming  $B(J/\psi(1S) \rightarrow e^+e^-) = (5.94 \pm 0.06) \times 10^{-2}$ ,  $B(\psi(2S) \rightarrow e^+e^-) = (7.72 \pm 0.17) \times 10^{-3}$ , which we rescale to our best values  $B(J/\psi(1S) \rightarrow e^+e^-) = (5.94 \pm 0.06) \times 10^{-2}$ ,  $B(\psi(2S) \rightarrow e^+e^-) = (7.82 \pm 0.17) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup> Assumes  $B(J/\psi \rightarrow \mu^+\mu^-) / B(\psi(2S) \rightarrow \mu^+\mu^-) = B(J/\psi \rightarrow e^+e^-) / B(\psi(2S) \rightarrow e^+e^-) = 7.69 \pm 0.19$ .

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

$\Gamma_{35}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>0.76 ± 0.19 OUR AVERAGE</b>		Error includes scale factor of 1.4.		
$0.99^{+0.23}_{-0.19} \pm 0.07$		<sup>1</sup> AAIJ	12AR LHCb	$pp$ at 7 TeV
$0.60 \pm 0.17 \pm 0.04$		<sup>2</sup> AALTONEN	12L CDF	$p\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 12	90	<sup>3</sup> PENG	10 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
< 1.2	90	<sup>4</sup> AALTONEN	09C CDF	Repl. by AALTONEN 12L
< 1.7	90	<sup>5</sup> ABULENCIA,A	06D CDF	Repl. by AALTONEN 09C
< 232	90	<sup>6</sup> ABE	00C SLD	$e^+e^- \rightarrow Z$
< 170	90	<sup>7</sup> BUSKULIC	96V ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> AAIJ 12AR reports  $[\Gamma(B_S^0 \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \pi^+\pi^-)] \times [\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0)] = 0.050^{+0.011}_{-0.009} \pm 0.004$  which we multiply or divide by our best values  $B(B^0 \rightarrow \pi^+\pi^-) = (5.12 \pm 0.19) \times 10^{-6}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.259 \pm 0.016$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup> AALTONEN 12L reports  $[\Gamma(B_S^0 \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^+\pi^-)] \times [\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0)] = 0.008 \pm 0.002 \pm 0.001$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+\pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.259 \pm 0.016$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>3</sup> Uses  $\Upsilon(10860) \rightarrow B_S^* \bar{B}_S^*$  and assumes  $B(\Upsilon(10860) \rightarrow B_S^{(*)} \bar{B}_S^{(*)}) = (19.3 \pm 2.9)\%$  and  $\Gamma(\Upsilon(10860) \rightarrow B_S^* \bar{B}_S^*) / \Gamma(\Upsilon(10860) \rightarrow B_S^{(*)} \bar{B}_S^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

<sup>4</sup> 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  $B(B^0 \rightarrow K^+\pi^-) = (19.4 \pm 0.6) \times 10^{-6}$ .

<sup>5</sup> ABULENCIA,A 06D obtains this from  $B(B_S \rightarrow \pi^+\pi^-) / B(B_S \rightarrow K^+K^-) < 0.05$  at 90% CL, assuming  $B(B_S \rightarrow K^+K^-) = (33 \pm 6 \pm 7) \times 10^{-6}$ .

<sup>6</sup> 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  $f_{B_S} = (10.5^{+1.8}_{-2.2})\%$ .

<sup>7</sup> BUSKULIC 96V assumes PDG 96 production fractions for  $B^0, B^+, B_S, b$  baryons.

$\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{36}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-4}$	90	<sup>1</sup> ACCIARRI	95H L3	$e^+e^- \rightarrow Z$

<sup>1</sup> ACCIARRI 95H assumes  $f_{B^0} = 39.5 \pm 4.0$  and  $f_{B_s} = 12.0 \pm 3.0\%$ .

$\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{37}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.0 \times 10^{-3}$	90	<sup>1</sup> ACCIARRI	95H L3	$e^+e^- \rightarrow Z$

<sup>1</sup> ACCIARRI 95H assumes  $f_{B^0} = 39.5 \pm 4.0$  and  $f_{B_s} = 12.0 \pm 3.0\%$ .

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$   $\Gamma_{38}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.5 \times 10^{-3}$	90	<sup>1</sup> ACCIARRI	95H L3	$e^+e^- \rightarrow Z$

<sup>1</sup> ACCIARRI 95H assumes  $f_{B^0} = 39.5 \pm 4.0$  and  $f_{B_s} = 12.0 \pm 3.0\%$ .

$\Gamma(\rho^0\rho^0)/\Gamma_{\text{total}}$   $\Gamma_{39}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.20 \times 10^{-4}$	90	<sup>1</sup> ABE	00C SLD	$e^+e^- \rightarrow Z$

<sup>1</sup> 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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

$\Gamma(\phi\rho^0)/\Gamma_{\text{total}}$   $\Gamma_{40}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.17 \times 10^{-4}$	90	<sup>1</sup> ABE	00C SLD	$e^+e^- \rightarrow Z$

<sup>1</sup> 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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

$\Gamma(\phi\phi)/\Gamma_{\text{total}}$   $\Gamma_{41}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
$17.7 \pm 2.4^{+5.7}_{-3.2}$		<sup>1</sup> AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV

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

14 $\frac{+6}{-5} \pm 6$		<sup>2</sup> ACOSTA	05J CDF	Repl. by AALTONEN 11AN
$<1183$	90	<sup>3</sup> ABE	00C SLD	$e^+e^- \rightarrow Z$

<sup>1</sup> AALTONEN 11AN reports  $[\Gamma(B_s^0 \rightarrow \phi\phi)/\Gamma_{\text{total}}] / [B(B_s^0 \rightarrow J/\psi(1S)\phi)] = (1.78 \pm 0.14 \pm 0.20) \times 10^{-2}$  which we multiply by our best value  $B(B_s^0 \rightarrow J/\psi(1S)\phi) = (10.0^{+3.2}_{-1.8}) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> Uses  $B(B^0 \rightarrow J/\psi\phi) = (1.38 \pm 0.49) \times 10^{-3}$  and production cross-section ratio of  $\sigma(B_s)/\sigma(B^0) = 0.26 \pm 0.04$ .

<sup>3</sup> 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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

$\Gamma(\pi^+ K^-)/\Gamma_{\text{total}}$   $\Gamma_{42}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**5.5 ± 0.6 OUR AVERAGE**

$5.6 \pm 0.6 \pm 0.4$		<sup>1</sup> AAIJ	12AR	LHCB $pp$ at 7 TeV
$5.4 \pm 0.9 \pm 0.4$		<sup>2</sup> AALTONEN	09C	CDF $p\bar{p}$ at 1.96 TeV

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

< 26	90	<sup>3</sup> PENG	10	BELL $e^+ e^- \rightarrow \gamma(5S)$
< 5.6	90	<sup>4</sup> ABULENCIA,A	06D	CDF Repl. by AALTONEN 09C
< 261	90	<sup>5</sup> ABE	00C	SLD $e^+ e^- \rightarrow Z$
< 210	90	<sup>6</sup> BUSKULIC	96V	ALEP $e^+ e^- \rightarrow Z$
< 260	90	<sup>7</sup> AKERS	94L	OPAL $e^+ e^- \rightarrow Z$

<sup>1</sup> AAIJ 12AR reports  $[\Gamma(B_s^0 \rightarrow \pi^+ K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^+ \pi^-)] \times [\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0)] = 0.074 \pm 0.006 \pm 0.006$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.259 \pm 0.016$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup> 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  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $B(\bar{b} \rightarrow B_s^0) = (10.4 \pm 0.6) \times 10^{-2}$ ,  $B(\bar{b} \rightarrow B^0) = (40.2 \pm 0.7) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>3</sup> Uses  $\gamma(10860) \rightarrow B_s^* \bar{B}_s^*$  and assumes  $B(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.3 \pm 2.9)\%$  and  $\Gamma(\gamma(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1_{-4.0}^{+3.8})\%$ .

<sup>4</sup> 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  $B(B^0 \rightarrow K^+ \pi^-) = (18.9 \pm 0.7) \times 10^{-6}$ .

<sup>5</sup> ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7_{-2.2}^{+1.8})\%$  and  $f_{B_s} = (10.5_{-2.2}^{+1.8})\%$ .

<sup>6</sup> BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.

<sup>7</sup> Assumes  $B(Z \rightarrow b\bar{b}) = 0.217$  and  $B_d^0$  ( $B_s^0$ ) fraction 39.5% (12%).

$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$   $\Gamma_{43}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**25.2 ± 1.7 OUR AVERAGE**

$23.9 \pm 1.6 \pm 1.6$		<sup>1</sup> AAIJ	12AR	LHCB $pp$ at 7 TeV
$26.3 \pm 2.2 \pm 1.8$		<sup>2</sup> AALTONEN	11N	CDF $p\bar{p}$ at 1.96 TeV
$38_{-9}^{+10} \pm 7$		<sup>3</sup> PENG	10	BELL $e^+ e^- \rightarrow \gamma(5S)$

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

< 310	90	DRUTSKOY	07A	BELL $e^+ e^- \rightarrow \gamma(5S)$
$33 \pm 6 \pm 7$		<sup>4</sup> ABULENCIA,A	06D	CDF Repl. by AALTONEN 11N
< 283	90	<sup>5</sup> ABE	00C	SLD $e^+ e^- \rightarrow Z$
< 59	90	<sup>6</sup> BUSKULIC	96V	ALEP $e^+ e^- \rightarrow Z$
< 140	90	<sup>7</sup> AKERS	94L	OPAL $e^+ e^- \rightarrow Z$

<sup>1</sup> AAIJ 12AR reports  $[\Gamma(B_S^0 \rightarrow K^+ K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^+ \pi^-)] \times [\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0)] = 0.316 \pm 0.009 \pm 0.019$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.259 \pm 0.016$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup> AALTONEN 11N reports  $(f_s/f_d) (B(B_S^0 \rightarrow K^+ K^-) / B(B^0 \rightarrow K^+ \pi^-)) = 0.347 \pm 0.020 \pm 0.021$ . We multiply this result by our best value of  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$  and divide by our best value of  $f_s/f_d$ , where  $1/2 f_s/f_d = 0.129 \pm 0.008$ . Our first quoted uncertainty is the combined experiment's uncertainty and our second is the systematic uncertainty from using our best values.

<sup>3</sup> Uses  $\Upsilon(10860) \rightarrow B_S^* \bar{B}_S^*$  and assumes  $B(\Upsilon(10860) \rightarrow B_S^{(*)} \bar{B}_S^{(*)}) = (19.3 \pm 2.9)\%$  and  $\Gamma(\Upsilon(10860) \rightarrow B_S^* \bar{B}_S^*) / \Gamma(\Upsilon(10860) \rightarrow B_S^{(*)} \bar{B}_S^{(*)}) = (90.1_{-4.0}^{+3.8})\%$ .

<sup>4</sup> 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  $B(B^0 \rightarrow K^+ \pi^-) = (18.9 \pm 0.7) \times 10^{-6}$ .

<sup>5</sup> ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7_{-2.2}^{+1.8})\%$  and  $f_{B_S} = (10.5_{-2.2}^{+1.8})\%$ .

<sup>6</sup> BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_S$ ,  $b$  baryons.

<sup>7</sup> Assumes  $B(Z \rightarrow b\bar{b}) = 0.217$  and  $B_d^0 (B_S^0)$  fraction 39.5% (12%).

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

$\Gamma_{44}/\Gamma$

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;6.6</b>	90	<sup>1</sup> PENG	10 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$

<sup>1</sup> Uses  $\Upsilon(10860) \rightarrow B_S^* \bar{B}_S^*$  and assumes  $B(\Upsilon(10860) \rightarrow B_S^{(*)} \bar{B}_S^{(*)}) = (19.3 \pm 2.9)\%$  and  $\Gamma(\Upsilon(10860) \rightarrow B_S^* \bar{B}_S^*) / \Gamma(\Upsilon(10860) \rightarrow B_S^{(*)} \bar{B}_S^{(*)}) = (90.1_{-4.0}^{+3.8})\%$ .

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

$\Gamma_{45}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;7.67 <math>\times 10^{-4}</math></b>	90	<sup>1</sup> ABE	00C SLD	$e^+ e^- \rightarrow Z$

<sup>1</sup> ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7_{-2.2}^{+1.8})\%$  and  $f_{B_S} = (10.5_{-2.2}^{+1.8})\%$ .

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

$\Gamma_{46}/\Gamma$

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>2.81 \pm 0.46 \pm 0.56</math></b>		<sup>1</sup> AAIJ	12F LHCB	$pp$ at 7 TeV

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

<168.1	90	<sup>2</sup> ABE	00C SLD	$e^+ e^- \rightarrow Z$
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<sup>1</sup> Uses  $B^0 \rightarrow J/\psi K^{*0}$  for normalization and assumes  $B(B^0 \rightarrow J/\psi K^{*0}) B(J/\psi \rightarrow \mu^+ \mu^-) B(K^{*0} \rightarrow K^+ \pi^-) = (1.33 \pm 0.06) \times 10^{-3}$  and  $f_s/f_d = 0.253 \pm 0.031$ . The second quoted error is total uncertainty including the error of 0.34 on  $f_s/f_d$ .

<sup>2</sup> ABE 00C assumes  $B(Z \rightarrow b\bar{b}) = (21.7 \pm 0.1)\%$  and the  $B$  fractions  $f_{B^0} = f_{B^+} = (39.7_{-2.2}^{+1.8})\%$  and  $f_{B_S} = (10.5_{-2.2}^{+1.8})\%$ .

$\Gamma(\phi K^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{47}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;10.13 × 10<sup>-4</sup></b>	90	<sup>1</sup> ABE	00C SLD	$e^+e^- \rightarrow Z$

<sup>1</sup> 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  $f_{B_s}=(10.5^{+1.8}_{-2.2})\%$ .

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$   $\Gamma_{48}/\Gamma$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;5.9 × 10<sup>-5</sup></b>	90	<sup>1</sup> BUSKULIC	96V ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{49}/\Gamma$

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

VALUE (units 10 <sup>-6</sup> )	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt; 8.7</b>	90	<sup>1</sup> WICHT	08A BELL	$e^+e^- \rightarrow \Upsilon(5S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 53	90	DRUTSKOY	07A BELL	Repl. by WICHT 08A
<148	90	<sup>2</sup> ACCIARRI	95I L3	$e^+e^- \rightarrow Z$

<sup>1</sup> Assumes  $\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^* = (19.5^{+3.0}_{-2.3})\%$ .  
<sup>2</sup> ACCIARRI 95I assumes  $f_{B^0} = 39.5 \pm 4.0$  and  $f_{B_s} = 12.0 \pm 3.0\%$ .

$\Gamma(\phi\gamma)/\Gamma_{\text{total}}$   $\Gamma_{50}/\Gamma$

VALUE (units 10 <sup>-6</sup> )	CL%	DOCUMENT ID	TECN	COMMENT
<b>36 ± 4 OUR AVERAGE</b>				
35.1 ± 3.5 ± 1.2		<sup>1</sup> AAIJ	13 LHCB	$pp$ at 7 TeV
57 <sup>+18</sup> <sub>-15</sub> <sup>+12</sup> <sub>-11</sub>		<sup>2</sup> WICHT	08A BELL	$e^+e^- \rightarrow \Upsilon(5S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
39 ± 5		<sup>3</sup> AAIJ	12AE LHCB	Replaced by AAIJ 13
<390	90	DRUTSKOY	07A BELL	$e^+e^- \rightarrow \Upsilon(5S)$
<120	90	ACOSTA	02G CDF	$p\bar{p}$ at 1.8 TeV
<700	90	<sup>4</sup> ADAM	96D DLPH	$e^+e^- \rightarrow Z$

<sup>1</sup> AAIJ 13 reports  $[\Gamma(B_s^0 \rightarrow \phi\gamma)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^*(892)^0\gamma)] = 0.81 \pm 0.04 \pm 0.07$  which we multiply by our best value  $B(B^0 \rightarrow K^*(892)^0\gamma) = (4.33 \pm 0.15) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> Assumes  $\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^* = (19.5^{+3.0}_{-2.3})\%$ .

<sup>3</sup> Measures  $B(B^0 \rightarrow K^{*0}\gamma)/B(B_s \rightarrow \phi\gamma) = 1.12 \pm 0.08(\text{stat})^{+0.06}_{-0.04}(\text{sys})^{+0.09}_{-0.08}(f_s/f_d)$  and uses current world-average value of  $B(B^0 \rightarrow K^{*0}\gamma) = (4.33 \pm 0.15) \times 10^{-5}$ .

<sup>4</sup> ADAM 96D assumes  $f_{B^0} = f_{B^-} = 0.39$  and  $f_{B_s} = 0.12$ .

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$					$\Gamma_{51}/\Gamma$
Test for $\Delta B = 1$ weak neutral current.					
VALUE (units $10^{-9}$ )	CL%	DOCUMENT ID	TECN	COMMENT	
<b><math>3.2^{+1.4+0.5}_{-1.2-0.3}</math></b>		1 AAIJ	13B LHCB	$\rho\rho$ at 7, 8 TeV	

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

< 19	90	2 AAD	12AE ATLS	$\rho\rho$ at 7 TeV	
< 12	90	3 AAIJ	12A LHCB	Repl. by AAIJ 12W	
< 3.8	90	4 AAIJ	12W LHCB	Repl. by AAIJ 13B	
< 6.4	90	5 CHATRCHYAN	12A CMS	$\rho\rho$ at 7 TeV	
< 43	90	6 AAIJ	11B LHCB	Repl. by AAIJ 12A	
< 35	90	7 AALTONEN	11AG CDF	$\rho\bar{p}$ at 1.96 TeV	
< 16	90	8 CHATRCHYAN	11T CMS	Repl. by CHATRCHYAN 12A	
< 42	90	9 ABAZOV	10S D0	$\rho\bar{p}$ at 1.96 TeV	
< 47	90	9 AALTONEN	08I CDF	Repl. by AALTONEN 11AG	
< 94	90	10 ABAZOV	07Q D0	Repl. by ABAZOV 10S	
< 410	90	11 ABAZOV	05E D0	$\rho\bar{p}$ at 1.96 TeV	
< 150	90	12 ABULENCIA	05 CDF	$\rho\bar{p}$ at 1.96 TeV	
< 580	90	13 ACOSTA	04D CDF	$\rho\bar{p}$ at 1.96 TeV	
< 2000	90	14 ABE	98 CDF	$\rho\bar{p}$ at 1.8 TeV	
< 38000	90	15 ACCIARRI	97B L3	$e^+e^- \rightarrow Z$	
< 8400	90	16 ABE	96L CDF	Repl. by ABE 98	

<sup>1</sup> Uses  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.256 \pm 0.020$  and two normalization modes:  $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+\mu^- K^+) = (6.01 \pm 0.21) \times 10^{-5}$  and  $B(B^0 \rightarrow K^+\pi^-) = (1.94 \pm 0.06) \times 10^{-5}$ .

<sup>2</sup> Uses  $B$  production ratio  $f(\bar{b} \rightarrow B^+)/f(\bar{b} \rightarrow B_s^0) = 3.75 \pm 0.29$  and  $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+\mu^- K^+) = (6.0 \pm 0.2) \times 10^{-5}$ .

<sup>3</sup> Uses  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.267^{+0.021}_{-0.020}$  and three normalization modes  $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+\mu^- K^+) = (6.01 \pm 0.21) \times 10^{-5}$ ,  $B(B^0 \rightarrow K^+\pi^-) = (1.94 \pm 0.06) \times 10^{-5}$ , and  $B(B_s^0 \rightarrow J/\psi\phi \rightarrow \mu^+\mu^- K^+K^-) = (3.4 \pm 0.9) \times 10^{-5}$ .

<sup>4</sup> Uses  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.267^{+0.021}_{-0.020}$  and three normalization modes of  $B^+ \rightarrow J/\psi K^+$ ,  $B^0 \rightarrow K^+\pi^-$ , and  $B_s^0 \rightarrow J/\psi\phi$ .

<sup>5</sup> Uses  $f_s/f_u = 0.267 \pm 0.021$  and  $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+\mu^- K^+) = (6.0 \pm 0.2) \times 10^{-5}$ .

<sup>6</sup> Uses  $B$  production ratio  $f(\bar{b} \rightarrow B^+)/f(\bar{b} \rightarrow B_s^0) = 3.71 \pm 0.47$  and three normalization modes.

<sup>7</sup> Uses  $B$  production ratio  $f(\bar{b} \rightarrow B^+)/f(\bar{b} \rightarrow B_s^0) = 3.55 \pm 0.47$  and  $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+\mu^- K^+) = (6.01 \pm 0.21) \times 10^{-5}$ .

<sup>8</sup> Uses  $B$  production ratio  $f(\bar{b} \rightarrow B^+)/f(\bar{b} \rightarrow B_s^0) = 3.55 \pm 0.42$  and  $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+\mu^- K^+) = (6.0 \pm 0.2) \times 10^{-5}$ .

<sup>9</sup> 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.

<sup>10</sup> 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.

<sup>11</sup> Assumes production cross-section  $\sigma(B_s)/\sigma(B^+) = 0.270 \pm 0.034$ .

<sup>12</sup> Assumes production cross section  $\sigma(B^+)/\sigma(B_s) = 3.71 \pm 0.41$  and  $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+\mu^- K^+) = (5.88 \pm 0.26) \times 10^{-5}$ .

<sup>13</sup> Assumes production cross-section  $\sigma(B_s)/\sigma(B^+) = 0.100/0.391$  and the CDF measured value of  $\sigma(B^+) = 3.6 \pm 0.6 \mu\text{b}$ .

<sup>14</sup> ABE 98 assumes production of  $\sigma(B^0) = \sigma(B^+)$  and  $\sigma(B_s)/\sigma(B^0) = 1/3$ . They normalize to their measured  $\sigma(B^0, p_T(B) > 6, |y| < 1.0) = 2.39 \pm 0.32 \pm 0.44 \mu\text{b}$ .

<sup>15</sup> ACCIARRI 97B assume PDG 96 production fractions for  $B^+$ ,  $B^0$ ,  $B_s$ , and  $\Lambda_b$ .

<sup>16</sup> ABE 96L assumes  $B^+/B_s$  production ratio 3/1. They normalize to their measured  $\sigma(B^+, p_T(B) > 6 \text{ GeV}/c, |y| < 1) = 2.39 \pm 0.54 \mu\text{b}$ .

### $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{52}/\Gamma$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-7}$	90	AALTONEN 09P	CDF	$\rho\bar{p}$ at 1.96 TeV

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

$<5.4 \times 10^{-5}$	90	<sup>1</sup> ACCIARRI 97B	L3	$e^+e^- \rightarrow Z$
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<sup>1</sup> ACCIARRI 97B assume PDG 96 production fractions for  $B^+$ ,  $B^0$ ,  $B_s$ , and  $\Lambda_b$ .

### $\Gamma(e^\pm\mu^\mp)/\Gamma_{\text{total}}$ $\Gamma_{53}/\Gamma$

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.0 \times 10^{-7}$	90	AALTONEN 09P	CDF	$\rho\bar{p}$ 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
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$<4.1 \times 10^{-5}$	90	<sup>1</sup> ACCIARRI 97B	L3	$e^+e^- \rightarrow Z$
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<sup>1</sup> ACCIARRI 97B assume PDG 96 production fractions for  $B^+$ ,  $B^0$ ,  $B_s$ , and  $\Lambda_b$ .

### $\Gamma(\phi(1020)\mu^+\mu^-)/\Gamma_{\text{total}}$ $\Gamma_{54}/\Gamma$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$<3.2 \times 10^{-6}$	90	<sup>1</sup> ABAZOV 06G	D0	$\rho\bar{p}$ at 1.96 TeV
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$<4.7 \times 10^{-5}$	90	ACOSTA 02D	CDF	$\rho\bar{p}$ at 1.8 TeV
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<sup>1</sup> Uses  $B(B_s^0 \rightarrow J/\psi\phi) = 9.3 \times 10^{-4}$ .

### $\Gamma(\phi(1020)\mu^+\mu^-)/\Gamma(J/\psi(1S)\phi)$ $\Gamma_{54}/\Gamma_{21}$

VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**1.13 ± 0.19 ± 0.07** AALTONEN 11AI CDF  $\rho\bar{p}$  at 1.96 TeV

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

1.11 ± 0.25 ± 0.09 AALTONEN 11L CDF Repl. by AALTONEN 11AI

<2.3 90 AALTONEN 09B CDF Repl. by AALTONEN 11L

### $\Gamma(\phi\nu\bar{\nu})/\Gamma_{\text{total}}$ $\Gamma_{55}/\Gamma$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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**<5.4 × 10<sup>-3</sup>** 90 <sup>1</sup> ADAM 96D DLPH  $e^+e^- \rightarrow Z$

<sup>1</sup> ADAM 96D assumes  $f_{B^0} = f_{B^-} = 0.39$  and  $f_{B_s} = 0.12$ .

## POLARIZATION IN $B_s^0$ DECAY

### $\Gamma_L/\Gamma$ in $B_s^0 \rightarrow D_s^* \rho^+$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.05^{+0.08+0.03}_{-0.10-0.04}$	LOUVOT	10	BELL $e^+e^- \rightarrow \gamma(5S)$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.542±0.011 OUR AVERAGE</b>				
$0.539 \pm 0.014 \pm 0.016$		<sup>1</sup> AAD	12CV ATLS	$p\bar{p}$ at 7 TeV
$0.524 \pm 0.013 \pm 0.015$		<sup>1</sup> AALTONEN	12D CDF	$p\bar{p}$ at 1.96 TeV
$0.558^{+0.017}_{-0.019}$		<sup>1,2</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV
$0.61 \pm 0.14 \pm 0.02$		<sup>3</sup> AFFOLDER	00N CDF	$p\bar{p}$ at 1.8 TeV
$0.56 \pm 0.21^{+0.02}_{-0.04}$	19	ABE	95Z CDF	$p\bar{p}$ at 1.8 TeV

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

$0.555 \pm 0.027 \pm 0.006$		<sup>4</sup> ABAZOV	09E D0	Repl. by ABAZOV 12D
$0.531 \pm 0.020 \pm 0.007$		<sup>1</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
$0.62 \pm 0.06 \pm 0.01$		ACOSTA	05 CDF	Repl. by AALTONEN 08J

<sup>1</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>2</sup> The error includes both statistical and systematic uncertainties.

<sup>3</sup> AFFOLDER 00N measurements are based on 40  $B_s^0$  candidates obtained from a data sample of 89 pb<sup>-1</sup>. The  $P$ -wave fraction is found to be  $0.23 \pm 0.19 \pm 0.04$ .

<sup>4</sup> Measured the angular and lifetime parameters for the time-dependent angular untagged decays  $B_d^0 \rightarrow J/\psi K^{*0}$  and  $B_s^0 \rightarrow J/\psi\phi$ .

### $\Gamma_L/\Gamma$ in $B_s^0 \rightarrow D_s^{*+} D_s^{*-}$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.06^{+0.18}_{-0.17} \pm 0.03$	ESEN	13	BELL $e^+e^- \rightarrow \gamma(5S)$

### $\Gamma_{\parallel}/\Gamma$ in $B_s^0 \rightarrow J/\psi(1S)\phi$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.227±0.010 OUR AVERAGE</b>			
$0.224 \pm 0.010 \pm 0.009$		<sup>1</sup> AAD	12CV ATLS $p\bar{p}$ at 7 TeV
$0.231 \pm 0.014 \pm 0.015$		<sup>1</sup> AALTONEN	12D CDF $p\bar{p}$ at 1.96 TeV
$0.231^{+0.024}_{-0.030}$		<sup>1,2</sup> ABAZOV	12D D0 $p\bar{p}$ at 1.96 TeV

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

$0.244 \pm 0.032 \pm 0.014$		<sup>3</sup> ABAZOV	09E D0	Repl. by ABAZOV 12D
$0.230 \pm 0.029 \pm 0.011$		<sup>1</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
$0.260 \pm 0.084 \pm 0.013$		ACOSTA	05 CDF	Repl. by AALTONEN 08J

<sup>1</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>2</sup> The error includes both statistical and systematic uncertainties.

<sup>3</sup> Measured the angular and lifetime parameters for the time-dependent angular untagged decays  $B_d^0 \rightarrow J/\psi K^{*0}$  and  $B_s^0 \rightarrow J/\psi\phi$ .



### $\phi_{\parallel}$ in $B_s^0 \rightarrow J/\psi(1S)\phi$

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
<b>3.15±0.22</b>	<sup>1</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV
2.72 <sup>+1.12</sup> <sub>-0.27</sub> ±0.26	ABAZOV	09E D0	Repl. by ABAZOV 12D

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

<sup>1</sup> The error includes both statistical and systematic uncertainties.

### $\Gamma_L/\Gamma$ for $B_s^0 \rightarrow J/\psi(1S)K^*(892)^0$

Longitudinal polarization fraction, equals to  $f_L$  using notation of "Polarization in  $B$  decays" review.

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.50±0.08±0.02</b>	<sup>1</sup> AAIJ	12AP LHCB	$pp$ at 7 TeV

<sup>1</sup> The non-resonant  $K\pi$  background contributions are subtracted. Also reports an  $S$ -wave amplitude  $|A_S|^2 = 0.07^{+0.15}_{-0.07}$ .

### $\Gamma_{\parallel}/\Gamma$ for $B_s^0 \rightarrow J/\psi(1S)K^*(892)^0$

Parallel polarization fraction, equals to  $1 - f_L - f_{\perp}$  using notation of "Polarization in  $B$  decays" review.

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.19<sup>+0.10</sup><sub>-0.08</sub>±0.02</b>	<sup>1</sup> AAIJ	12AP LHCB	$pp$ at 7 TeV

<sup>1</sup> The non-resonant  $K\pi$  background contributions are subtracted. Also reports an  $S$ -wave amplitude  $|A_S|^2 = 0.07^{+0.15}_{-0.07}$ .

### $\Gamma_L/\Gamma$ in $B_s^0 \rightarrow \phi\phi$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.361±0.022 OUR AVERAGE</b>			
0.365±0.022±0.012	AAIJ	12P LHCB	$pp$ at 7 TeV
0.348±0.041±0.021	AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV

### $\Gamma_{\perp}/\Gamma$ in $B_s^0 \rightarrow \phi\phi$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.306±0.030 OUR AVERAGE</b>	Error includes scale factor of 1.3.		
0.291±0.024±0.010	AAIJ	12P LHCB	$pp$ at 7 TeV
0.365±0.044±0.027	AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV

### $\phi_{\parallel}$ in $B_s^0 \rightarrow \phi\phi$

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
<b>2.59±0.15 OUR AVERAGE</b>			
2.57±0.15±0.06	<sup>1</sup> AAIJ	12P LHCB	$pp$ at 7 TeV
2.71 <sup>+0.31</sup> <sub>-0.36</sub> ±0.22	<sup>2</sup> AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV

<sup>1</sup> AAIJ 12P quotes  $\cos\phi_{\parallel} = -0.844 \pm 0.068 \pm 0.029$  which we convert to  $\phi_{\parallel}$ , taking the smaller solution.

<sup>2</sup> AALTONEN 11AN quotes  $\cos\phi_{\parallel} = -0.91^{+0.15}_{-0.13} \pm 0.09$  which we convert to  $\phi_{\parallel}$  taking the smaller solution.

$\Gamma_L/\Gamma$  in  $B_s^0 \rightarrow K^{*0}\bar{K}^{*0}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.31±0.12±0.04</b>	AAIJ	12F	LHCB $pp$ at 7 TeV

$\Gamma_{\perp}/\Gamma$  in  $B_s^0 \rightarrow K^{*0}\bar{K}^{*0}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.38±0.11±0.04</b>	AAIJ	12F	LHCB $pp$ at 7 TeV

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

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

$\chi_s$  is a measure of the time-integrated  $B_s^0-\bar{B}_s^0$  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  $2\pi$  times the  $B_s^0-\bar{B}_s^0$  oscillation frequency in time-dependent mixing experiments.

“OUR EVALUATION” is provided by the Heavy Flavor Averaging Group (HFAG) by taking into account correlations between measurements.

VALUE ( $10^{12} \hbar s^{-1}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>17.69±0.08 OUR EVALUATION</b>				
<b>17.69±0.08 OUR AVERAGE</b>				
17.63±0.11±0.02		1 AAIJ	12I	LHCB $pp$ at 7 TeV
17.77±0.10±0.07		2 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	3 ABAZOV	06B D0	$p\bar{p}$ at 1.96 TeV
17.31 <sup>+0.33</sup> <sub>-0.18</sub> ±0.07		4 ABULENCIA	06Q CDF	Repl. by ABULENCIA,A 06G
> 8.0	95	5 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 4.9	95	6 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 8.5	95	7 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 5.0	95	8 ABDALLAH	03B DLPH	$e^+e^- \rightarrow Z$
>10.3	95	9 ABE	03 SLD	$e^+e^- \rightarrow Z$
>10.9	95	10 HEISTER	03E ALEP	$e^+e^- \rightarrow Z$
> 5.3	95	11 ABE	02V SLD	$e^+e^- \rightarrow Z$

> 1.0	95	12	ABBIENDI	01D	OPAL	$e^+e^- \rightarrow Z$
> 7.4	95	13	ABREU	00Y	DLPH	Repl. by ABDALLAH 04J
> 4.0	95	14	ABREU,P	00G	DLPH	$e^+e^- \rightarrow Z$
> 5.2	95	15	ABBIENDI	99S	OPAL	$e^+e^- \rightarrow Z$
<96	95	16	ABE	99D	CDF	$p\bar{p}$ at 1.8 TeV
> 5.8	95	17	ABE	99J	CDF	$p\bar{p}$ at 1.8 TeV
> 9.6	95	18	BARATE	99J	ALEP	$e^+e^- \rightarrow Z$
> 7.9	95	19	BARATE	98C	ALEP	Repl. by BARATE 99J
> 3.1	95	20	ACKERSTAFF	97U	OPAL	Repl. by ABBIENDI 99S
> 2.2	95	21	ACKERSTAFF	97V	OPAL	Repl. by ABBIENDI 99S
> 6.5	95	22	ADAM	97	DLPH	Repl. by ABREU 00Y
> 6.6	95	23	BUSKULIC	96M	ALEP	Repl. by BARATE 98C
> 2.2	95	21	AKERS	95J	OPAL	Sup. by ACKERSTAFF 97V
> 5.7	95	24	BUSKULIC	95J	ALEP	$e^+e^- \rightarrow Z$
> 1.8	95	21	BUSKULIC	94B	ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> Measured using  $B_s^0 \rightarrow D_s^- \pi^+$  and  $D_s^- \pi^+ \pi^- \pi^+$  decays.

<sup>2</sup> Significance of oscillation signal is  $5.4 \sigma$ . Also reports  $|V_{td} / V_{ts}| = 0.2060 \pm 0.0007^{+0.0081}_{-0.0060}$ .

<sup>3</sup> A likelihood scan over the oscillation frequency,  $\Delta m_s$ , gives a most probable value of  $19 \text{ ps}^{-1}$  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.

<sup>4</sup> Significance of oscillation signal is 0.2%. Also reported the value  $|V_{td} / V_{ts}| = 0.208^{+0.001+0.008}_{-0.002-0.006}$ .

<sup>5</sup> Uses leptons emitted with large momentum transverse to a jet and improved techniques for vertexing and flavor-tagging.

<sup>6</sup> Updates of  $D_s$ -lepton analysis.

<sup>7</sup> Combined results from all Delphi analyses.

<sup>8</sup> Events with a high transverse momentum lepton were removed and an inclusively reconstructed vertex was required.

<sup>9</sup> 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  $7.9 < \Delta m_s < 10.3 \text{ ps}^{-1}$ .

<sup>10</sup> Three analyses based on complementary event selections: (1) fully-reconstructed hadronic decays; (2) semileptonic decays with  $D_s$  exclusively reconstructed; (3) inclusive semileptonic decays.

<sup>11</sup> 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.

<sup>12</sup> Uses fully or partially reconstructed  $D_s \ell$  vertices and a mixing tag as a flavor tagging.

<sup>13</sup> Replaced by ABDALLAH 04A. Uses  $D_s^- \ell^+$ , and  $\phi \ell^+$  vertices, and a multi-variable discriminant as a flavor tagging.

<sup>14</sup> Uses inclusive  $D_s$  vertices and fully reconstructed  $B_s$  decays and a multi-variable discriminant as a flavor tagging.

<sup>15</sup> Uses  $\ell$ - $Q_{\text{hem}}$  and  $\ell$ - $\ell$ .

<sup>16</sup> ABE 99D assumes  $\tau_{B_s^0} = 1.55 \pm 0.05 \text{ ps}$  and  $\Delta\Gamma/\Delta m = (5.6 \pm 2.6) \times 10^{-3}$ .

<sup>17</sup> ABE 99J uses  $\phi$   $\ell$ - $\ell$  correlation.

<sup>18</sup> BARATE 99J uses combination of an inclusive lepton and  $D_s^-$ -based analyses.

<sup>19</sup> 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.

<sup>20</sup> Uses  $\ell$ - $Q_{\text{hem}}$ .

<sup>21</sup> Uses  $\ell$ - $\ell$ .

<sup>22</sup> ADAM 97 combines results from  $D_s$   $\ell$ - $Q_{\text{hem}}$ ,  $\ell$ - $Q_{\text{hem}}$ , and  $\ell$ - $\ell$ .

<sup>23</sup> BUSKULIC 96M uses  $D_s$  lepton correlations and lepton, kaon, and jet charge tags.

<sup>24</sup> BUSKULIC 95J uses  $\ell$ - $Q_{\text{hem}}$ . 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

**26.82 ± 0.23 OUR EVALUATION**

$\chi_s$

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

VALUE

DOCUMENT ID

**0.499309 ± 0.000012 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. The value has been obtained from a 2D fit of the  $B_d$  and  $B_s$  asymmetries, which includes the  $B_s$  measurements listed below and the  $B$  factory average for the  $B_d$ .

VALUE (units  $10^{-3}$ )

DOCUMENT ID

TECN

COMMENT

**-4.3 ± 1.4 OUR EVALUATION**

**-2.4 ± 1.3 OUR AVERAGE**

-2.8 ± 1.9 ± 0.4

<sup>1</sup> ABAZOV

13

D0

$\rho\bar{p}$  at 1.96 TeV

-4.5 ± 2.7

<sup>2</sup> ABAZOV

11U

D0

$\rho\bar{p}$  at 1.96 TeV

-0.4 ± 2.3 ± 0.4

<sup>3</sup> ABAZOV

10E

D0

$\rho\bar{p}$  at 1.96 TeV

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

-3.6 ± 1.9

<sup>4</sup> ABAZOV

10H

D0

Repl. by ABAZOV 11U

6.1 ± 4.8 ± 0.9

<sup>5</sup> ABAZOV

07A

D0

Repl. by ABAZOV 10E

<sup>1</sup> ABAZOV 13 reports a measurement of time-integrated flavor-specific asymmetry in mixed semileptonic  $B_s^0 \rightarrow \mu^+ D_s^- X$  decays  $A_s^{SL} = (-1.12 \pm 0.74 \pm 0.17)\%$  which is approximately equal to  $4 \times \text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2)$ .

<sup>2</sup> ABAZOV 11U uses the dimuon charge asymmetry with different impact parameters from which it reports  $A_{SL}^s = (-18.1 \pm 10.6) \times 10^{-3}$ .

<sup>3</sup> ABAZOV 10E reports a measurement of flavor-specific asymmetry in  $B_{(s)}^0 \rightarrow \mu^+ D_{(s)}^{*-} X$  decays with a decay-time analysis including initial-state flavor tagging,  $A_{SL}^s = (-1.7 \pm 9.1_{-1.5}^{+1.4}) \times 10^{-3}$  which is approximately equal to  $4 \times \text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2)$ .

<sup>4</sup> ABAZOV 10H reports a measurement of like-sign dimuon charge asymmetry of  $A_{SL}^b = (-9.57 \pm 2.51 \pm 1.46) \times 10^{-3}$  in semileptonic  $b$ -hadron decays. Using the measured production ratio of  $B_d^0$  and  $B_s^0$ , and the asymmetry of  $B_d^0$   $A_{SL}^d = (-4.7 \pm 4.6) \times 10^{-3}$  measured from  $B$ -factories, they obtain the asymmetry for  $B_s^0$ .

<sup>5</sup> The first direct measurement of the time integrated flavor untagged charge asymmetry in semileptonic  $B_s^0$  decays is reported as  $2 \times A_{SL}^s(\text{untagged}) = A_{SL}^s = (2.45 \pm 1.93 \pm 0.35) \times 10^{-2}$ .

### CP Violation phase $\beta_s$

$-2\beta_s$  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  $\beta_s$  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.

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>4 <math>\begin{smallmatrix} +10 \\ -13 \end{smallmatrix}</math> OUR EVALUATION</b>			
<b>- 1 <math>\pm 6</math> OUR AVERAGE</b>			
-11.0 $\pm 20.5 \pm 5.0$	<sup>1</sup> AAD	12CV ATLS	$\rho\rho$ at 7 TeV
- 8 $\pm 9 \pm 3$	<sup>2</sup> AAIJ	12D LHCb	$\rho\rho$ at 7 TeV
0.95 $\begin{smallmatrix} + 8.70+0.15 \\ - 8.65-0.20 \end{smallmatrix}$	<sup>3</sup> AAIJ	12Q LHCb	$\rho\rho$ at 7 TeV
	<sup>4</sup> AALTONEN	12AJ CDF	$\rho\bar{p}$ at 1.96 TeV
28 $\begin{smallmatrix} +18 \\ -19 \end{smallmatrix}$	<sup>5,6,7</sup> ABAZOV	12D D0	$\rho\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
22 $\pm 22 \pm 1$	<sup>8</sup> AAIJ	12B LHCb	Repl. by AAIJ 12Q
	<sup>9</sup> AALTONEN	12D CDF	Repl. by AALTONEN 12AJ
	<sup>10</sup> AALTONEN	08G CDF	Repl. by AALTONEN 12D
28 $\begin{smallmatrix} +12 \\ -15 \end{smallmatrix} \begin{smallmatrix} +4 \\ -1 \end{smallmatrix}$	<sup>6,11</sup> ABAZOV	08AMD0	Repl. by ABAZOV 12D
39.5 $\pm 28.0 \begin{smallmatrix} +0.5 \\ -7.0 \end{smallmatrix}$	<sup>7,12</sup> ABAZOV	07 D0	Repl. by ABAZOV 07N
35 $\begin{smallmatrix} +20 \\ -24 \end{smallmatrix}$	<sup>7,13</sup> ABAZOV	07N D0	Repl. by ABAZOV 08AM

<sup>1</sup> AAD 12CV reports  $\phi_s = -2\beta_s = 0.22 \pm 0.41 \pm 0.10$  rad. that was measured using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.

<sup>2</sup> Reports  $\phi_s = -2\beta_s = 0.15 \pm 0.18 \pm 0.06$  that was measured using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.

<sup>3</sup> Reports  $\phi_s = -2\beta_s = -0.019_{-0.174-0.003}^{+0.173+0.004}$  radians which was measured using a time-dependent fit to  $B_s^0 \rightarrow J/\psi \pi^+ \pi^-$  decays, with the  $\pi^+ \pi^-$  mass within 775–1550 MeV. Searches for, but finds no evidence, for direct  $CP$  violation in  $B_s^0 \rightarrow J/\psi \pi \pi$  decays.

- <sup>4</sup> AALTONEN 12AJ reports  $-\pi/2 < \beta_S < -1.51$  or  $-0.06 < \beta_S < 0.30$ , or  $1.26 < \beta_S < \pi/2$  at 68% CL. Measured using the time-dependent angular analysis of  $B_S^0 \rightarrow J/\psi \phi$  decays.
- <sup>5</sup> The error includes both statistical and systematic uncertainties.
- <sup>6</sup> Measured using fully reconstructed  $B_S \rightarrow J/\psi \phi$  decays.
- <sup>7</sup> Reports  $\phi_S$  which equals to  $-2\beta_S$ .
- <sup>8</sup> Reports  $\phi_S = -2\beta_S = -0.44 \pm 0.44 \pm 0.02$  that was measured using a time-dependent fit to  $B_S^0 \rightarrow J/\psi f_0(980)$  decays.
- <sup>9</sup> Reports  $0.02 < \phi_S < 0.52$  or  $1.08 < \phi_S < 1.55$  at 68% C.L. confidence regions in the two-dimensional space of  $\phi_S$  and  $\Delta\Gamma_{B_S^0}$  from  $B_S^0 \rightarrow J/\psi \phi$  decays.
- <sup>10</sup> 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%.
- <sup>11</sup> Reports  $\phi_S = -2\beta_S$  and obtains 90% CL interval  $-0.03 < \beta_S < 0.60$ .
- <sup>12</sup> 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.
- <sup>13</sup> 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.

**$A_{CP}(B_S \rightarrow \pi^+ K^-)$**   
 $A_{CP}$  is defined as

$$\frac{B(\bar{B}_S^0 \rightarrow f) - B(B_S^0 \rightarrow \bar{f})}{B(\bar{B}_S^0 \rightarrow f) + B(B_S^0 \rightarrow \bar{f})},$$

the  $CP$ -violation asymmetry of exclusive  $B_S^0$  and  $\bar{B}_S^0$  decay.

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.29 ± 0.07 OUR AVERAGE</b>			
0.27 ± 0.08 ± 0.02	AAIJ	12V	LHCB $pp$ at 7 TeV
0.39 ± 0.15 ± 0.08	AALTONEN	11N	CDF $p\bar{p}$ at 1.96 TeV

**$A_{CP}(B_S^0 \rightarrow [K^+ K^-]_D \bar{K}^*(892)^0)$**

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.04 ± 0.16 ± 0.01</b>	AAIJ	13L	LHCB $pp$ at 7 TeV

**PARTIAL BRANCHING FRACTIONS IN  $B_S \rightarrow \phi \ell^+ \ell^-$**

**$B(B_S \rightarrow \phi \ell^+ \ell^-) (q^2 < 2.0 \text{ GeV}^2/c^2)$**

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.78 ± 0.95 ± 0.89</b>	AALTONEN	11AI	CDF $p\bar{p}$ at 1.96 TeV

**$B(B_S \rightarrow \phi \ell^+ \ell^-) (2.0 < q^2 < 4.3 \text{ GeV}^2/c^2)$**

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b>0.58 ± 0.55 ± 0.19</b>	AALTONEN	11AI	CDF $p\bar{p}$ at 1.96 TeV

**$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $4.3 < q^2 < 8.68 \text{ GeV}^2/c^2$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.34±0.83±0.43</b>	AALTONEN 11A1	CDF	$p\bar{p}$ at 1.96 TeV

**$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $10.09 < q^2 < 12.86 \text{ GeV}^2/c^2$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2.98±0.95±0.95</b>	AALTONEN 11A1	CDF	$p\bar{p}$ at 1.96 TeV

**$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $14.18 < q^2 < 16.0 \text{ GeV}^2/c^2$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.86±0.66±0.59</b>	AALTONEN 11A1	CDF	$p\bar{p}$ at 1.96 TeV

**$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $16.0 < q^2 < 16.0 \text{ GeV}^2/c^2$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2.32±0.76±0.74</b>	AALTONEN 11A1	CDF	$p\bar{p}$ at 1.96 TeV

**$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $1.0 < q^2 < 6.0 \text{ GeV}^2/c^2$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.14±0.79±0.36</b>	AALTONEN 11A1	CDF	$p\bar{p}$ at 1.96 TeV

**$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $0.0 < q^2 < 4.3 \text{ GeV}^2/c^2$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3.30±1.09±1.05</b>	AALTONEN 11A1	CDF	$p\bar{p}$ at 1.96 TeV

**$B_s^0$  REFERENCES**

AAIJ	13	NP B867 1	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13A	NP B867 547	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13B	PRL 110 021801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13L	JHEP 1303 067	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	13	PRL 110 011801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ESEN	13	PR D87 031101	S. Esen <i>et al.</i>	(BELLE Collab.)
AAD	12AE	PL B713 387	G. Aad <i>et al.</i>	(ATLAS Collab.)
AAD	12CV	JHEP 1212 072	G. Aad <i>et al.</i>	(ATLAS Collab.)
AAIJ	12	PL B707 349	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12A	PL B708 55	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12AE	PR D85 112013	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12AG	JHEP 1206 115	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12AM	PRL 109 131801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12AN	PRL 109 152002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12AO	PR D86 052006	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12AP	PR D86 071102	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12AR	JHEP 1210 037	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12AX	PR D86 112005	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12B	PL B707 497	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12D	PRL 108 101803	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12E	PL B708 241	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12F	PL B709 50	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12I	PL B709 177	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12L	EPJ C72 2118	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12O	PL B713 172	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12P	PL B713 369	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12Q	PL B713 378	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12R	PL B716 393	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12S	PRL 108 151801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12V	PRL 108 201601	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12W	PRL 108 231801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	12AJ	PRL 109 171802	T. Aaltonen <i>et al.</i>	(CDF Collab.)

AALTONEN	12C	PRL 108 201801	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	12D	PR D85 072002	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	12L	PRL 108 211803	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	12AF	PR D86 092011	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	12C	PR D85 011103	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	12D	PR D85 032006	V.M. Abazov <i>et al.</i>	(D0 Collab.)
CHATRCHYAN	12A	JHEP 1204 033	S. Chatrchyan <i>et al.</i>	(CMS Collab.)
LEES	12A	PR D85 011101	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LI	12	PRL 108 181808	J. Li <i>et al.</i>	(BELLE Collab.)
AAIJ	11	PL B698 115	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	11A	PL B698 14	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	11B	PL B699 330	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	11D	PL B706 32	R. Aaij, <i>et al.</i>	(LHCb Collab.)
AAIJ	11E	PR D84 092001	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D85 039904 (errata)	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	11A	PR D83 052012	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	11AB	PR D84 052012	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	11AG	PRL 107 191801	T. Aaltonen <i>et al.</i>	(CDF Collab.)
Also		PRL 107 239903 (errata)	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	11AI	PRL 107 201802	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	11AN	PRL 107 261802	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	11AP	PRL 107 272001	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	11L	PRL 106 161801	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	11N	PRL 106 181802	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	11U	PR D84 052007	V.M. Abazov <i>et al.</i>	(D0 Collab.)
CHATRCHYAN	11T	PRL 107 191802	S. Chatrchyan <i>et al.</i>	(CMS Collab.)
LI	11	PRL 106 121802	J. Li <i>et al.</i>	(BELLE Collab.)
ABAZOV	10E	PR D82 012003	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	10H	PR D82 032001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	10S	PL B693 539	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ESEN	10	PRL 105 201802	S. Esen <i>et al.</i>	(BELLE Collab.)
LOUVOT	10	PRL 104 231801	R. LOUVOT <i>et al.</i>	(BELLE Collab.)
PENG	10	PR D82 072007	C.-C. Peng <i>et al.</i>	(BELLE Collab.)
AALTONEN	09AQ	PRL 103 191802	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	09B	PR D79 011104	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 111102	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 031107	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 (errata)	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 111101	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 071101	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 (errat)	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. Buskulic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	96M	PL B377 205	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	96V	PL B384 471	D. Buskulic <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. Buskulic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	95O	PL B361 221	D. Buskulic <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. Buskulic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	94C	PL B322 275	D. Buskulic <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. Buskulic <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. Buskulic <i>et al.</i>	(ALEPH Collab.)
LEE-FRANZINI	90	PRL 65 2947	J. Lee-Franzini <i>et al.</i>	(CUSB II Collab.)