

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

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

### $B_s^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>5366.89 ± 0.19 OUR FIT</b>				
<b>5366.84 ± 0.30 OUR AVERAGE</b>				Error includes scale factor of 1.2.
5367.08 ± 0.38 ± 0.15	128	<sup>1</sup> AAIJ	16U LHCb	$pp$ at 7, 8 TeV
5366.90 ± 0.28 ± 0.23		<sup>2</sup> AAIJ	12E LHCb	$pp$ at 7 TeV
5364.4 ± 1.3 ± 0.7		LOUVOT	09 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
5366.01 ± 0.73 ± 0.33		<sup>3</sup> ACOSTA	06 CDF	$p\bar{p}$ at 1.96 TeV
5369.9 ± 2.3 ± 1.3	32	<sup>4</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>4</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>5</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 $J/\psi \rightarrow \mu^+\mu^-$ , $\phi \rightarrow K^+K^-$ decays, and observes $128 \pm 13$ events of $B_s^0 \rightarrow J/\psi\phi\phi$ .				
<sup>2</sup> Uses $B_s^0 \rightarrow J/\psi\phi$ fully reconstructed decays.				
<sup>3</sup> Uses exclusively reconstructed final states containing a $J/\psi \rightarrow \mu^+\mu^-$ decays.				
<sup>4</sup> From the decay $B_s \rightarrow J/\psi(1S)\phi$ .				
<sup>5</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>87.42 ± 0.19 OUR FIT</b>				
<b>87.42 ± 0.24 OUR AVERAGE</b>				
87.60 ± 0.44 ± 0.09		<sup>1</sup> AAIJ	15U LHCb	$pp$ at 7, 8 TeV
87.42 ± 0.30 ± 0.09		<sup>2</sup> AAIJ	12E LHCb	$pp$ at 7 TeV
86.64 ± 0.80 ± 0.08		<sup>3</sup> ACOSTA	06 CDF	$p\bar{p}$ at 1.96 TeV
• • • We use the following data for averages but not for fits. • • •				
89.7 ± 2.7 ± 1.2		ABE	96B CDF	$p\bar{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
80 to 130	68	LEE-FRANZINI90	CSB2	$e^+e^- \rightarrow \Upsilon(5S)$
<sup>1</sup> The reported result is $m_{B_s^0} - m_{B^0} = 87.45 \pm 0.44 \pm 0.09$ MeV. We convert it to the mass difference with respect to the average of $(m_{B^\pm} + m_{B^0})/2$ . Uses the mode $B_s^0 \rightarrow \psi(2S)K^- \pi^+$ .				

<sup>2</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>3</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  $(m_{B^\pm} + m_{B^0})/2$ .

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

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

## $B_s^0$ MEAN LIFE

"OUR EVALUATION" is provided by the Heavy Flavor Averaging Group (HFLAV). It is derived from the average of  $\Gamma_{B_s^0}$ .

VALUE ( $10^{-12}$ s)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.509 ± 0.004 OUR EVALUATION</b>				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.518 ± 0.041 ± 0.027		<sup>1</sup> AALTONEN	11AP CDF	$\rho\bar{\rho}$ at 1.96 TeV
1.398 ± 0.044 $\begin{smallmatrix} +0.028 \\ -0.025 \end{smallmatrix}$		<sup>2</sup> ABAZOV	06V D0	$\rho\bar{\rho}$ at 1.96 TeV
1.42 $\begin{smallmatrix} +0.14 \\ -0.13 \end{smallmatrix}$ ± 0.03		<sup>3</sup> ABREU	00Y DLPH	$e^+e^- \rightarrow Z$
1.53 $\begin{smallmatrix} +0.16 \\ -0.15 \end{smallmatrix}$ ± 0.07		<sup>4</sup> ABREU,P	00G DLPH	$e^+e^- \rightarrow Z$
1.36 ± 0.09 $\begin{smallmatrix} +0.06 \\ -0.05 \end{smallmatrix}$		<sup>5</sup> ABE	99D CDF	$\rho\bar{\rho}$ at 1.8 TeV
1.72 $\begin{smallmatrix} +0.20 \\ -0.19 \end{smallmatrix}$ $\begin{smallmatrix} +0.18 \\ -0.17 \end{smallmatrix}$		<sup>6</sup> ACKERSTAFF	98F OPAL	$e^+e^- \rightarrow Z$
1.50 $\begin{smallmatrix} +0.16 \\ -0.15 \end{smallmatrix}$ ± 0.04		<sup>5</sup> ACKERSTAFF	98G OPAL	$e^+e^- \rightarrow Z$
1.47 ± 0.14 ± 0.08		<sup>4</sup> BARATE	98C ALEP	$e^+e^- \rightarrow Z$
1.51 ± 0.11		<sup>7</sup> BARATE	98C ALEP	$e^+e^- \rightarrow Z$
1.56 $\begin{smallmatrix} +0.29 \\ -0.26 \end{smallmatrix}$ $\begin{smallmatrix} +0.08 \\ -0.07 \end{smallmatrix}$		<sup>5</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.65 $\begin{smallmatrix} +0.34 \\ -0.31 \end{smallmatrix}$ ± 0.12		<sup>4</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.76 ± 0.20 $\begin{smallmatrix} +0.15 \\ -0.10 \end{smallmatrix}$		<sup>8</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.60 ± 0.26 $\begin{smallmatrix} +0.13 \\ -0.15 \end{smallmatrix}$		<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 $\begin{smallmatrix} +0.30 \\ -0.29 \end{smallmatrix}$ $\begin{smallmatrix} +0.18 \\ -0.16 \end{smallmatrix}$	90	<sup>4</sup> BUSKULIC	96E ALEP	Repl. by BARATE 98C
1.54 $\begin{smallmatrix} +0.14 \\ -0.13 \end{smallmatrix}$ ± 0.04		<sup>5</sup> BUSKULIC	96M ALEP	$e^+e^- \rightarrow Z$
1.42 $\begin{smallmatrix} +0.27 \\ -0.23 \end{smallmatrix}$ ± 0.11	76	<sup>5</sup> ABE	95R CDF	Repl. by ABE 99D
1.74 $\begin{smallmatrix} +1.08 \\ -0.69 \end{smallmatrix}$ ± 0.07	8	<sup>11</sup> ABE	95R CDF	Sup. by ABE 96N
1.54 $\begin{smallmatrix} +0.25 \\ -0.21 \end{smallmatrix}$ ± 0.06	79	<sup>5</sup> AKERS	95G OPAL	Repl. by ACKERSTAFF 98G

1.59	$\begin{smallmatrix} +0.17 \\ -0.15 \end{smallmatrix}$	$\pm 0.03$	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	$\begin{smallmatrix} +0.45 \\ -0.35 \end{smallmatrix}$	$\pm 0.04$	31	<sup>5</sup> BUSKULIC	94C ALEP	Sup. by BUSKULIC 95O
1.13	$\begin{smallmatrix} +0.35 \\ -0.26 \end{smallmatrix}$	$\pm 0.09$	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.

## $\Gamma_{B_S^0}$

"OUR EVALUATION" is an average performed by the Heavy Flavor Averaging Group (HFLAV) as described in our "Review on  $B$ - $\bar{B}$  Mixing" in the  $B^0$  section of these Listings. It includes the measurements of  $\Gamma_{B_S^0}$  and  $\Delta\Gamma_{B_S^0}$  listed in this section, as well as constraints from effective lifetimes with pure  $CP$  modes and flavor-specific modes.

<u>VALUE (<math>10^{12} \text{ s}^{-1}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.6629 ± 0.0018 OUR EVALUATION</b>			
<b>0.664 ± 0.004 OUR AVERAGE</b>	Error includes scale factor of 1.7. See the ideogram below.		
0.650 ± 0.006 ± 0.004	<sup>1</sup> AAIJ	17V LHCb	$pp$ at 7, 8 TeV
0.675 ± 0.003 ± 0.003	<sup>2</sup> AAD	16AP ATLAS	$pp$ at 7, 8 TeV
0.668 ± 0.011 ± 0.006	<sup>3</sup> AAIJ	16AK LHCb	$pp$ at 7, 8 TeV
0.6704 ± 0.0043 ± 0.0055	<sup>2</sup> KHACHATRY...	16S CMS	$pp$ at 8 TeV
0.6603 ± 0.0027 ± 0.0015	<sup>4</sup> AAIJ	15I LHCb	$pp$ at 7, 8 TeV
0.654 ± 0.008 ± 0.004	<sup>2</sup> AALTONEN	12AJ CDF	$p\bar{p}$ at 1.96 TeV
0.693 $\begin{smallmatrix} +0.018 \\ -0.017 \end{smallmatrix}$	<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. ● ● ●			
0.677 ± 0.007 ± 0.004	<sup>2</sup> AAD	14U ATLAS	Repl. by AAD 16AP
0.661 ± 0.004 ± 0.006	<sup>5</sup> AAIJ	13AR LHCb	Repl. by AAIJ 15I
0.677 ± 0.007 ± 0.004	<sup>2</sup> AAD	12CV ATLAS	Repl. by AAD 14U
0.657 ± 0.009 ± 0.008	<sup>2</sup> AAIJ	12D LHCb	Repl. by AAIJ 13AR

0.654 ±0.011 ±0.005	2,6 AALTONEN	12D CDF	Repl. by AALTONEN 12AJ
0.672 ±0.027 ±0.013	2 ABAZOV	09E D0	Repl. by ABAZOV 08AM
0.658 ±0.017 ±0.009	2,7 AALTONEN	08J CDF	Repl. by AALTONEN 12D
0.658 ±0.022 ±0.004	2 ABAZOV	08AMD0	Repl. by ABAZOV 12D
0.658 ±0.035 <sup>+0.0130</sup> <sub>-0.004</sub>	2,7 ABAZOV	07 D0	Repl. by ABAZOV 09E
0.714 <sup>+0.007</sup> <sub>-0.008</sub> ±0.010	2,7 ACOSTA	05 CDF	Repl. by AALTONEN 08J

<sup>1</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi K^+ K^-$  in the region  $m(K K) > 1.05$  GeV.

<sup>2</sup> Measured using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.

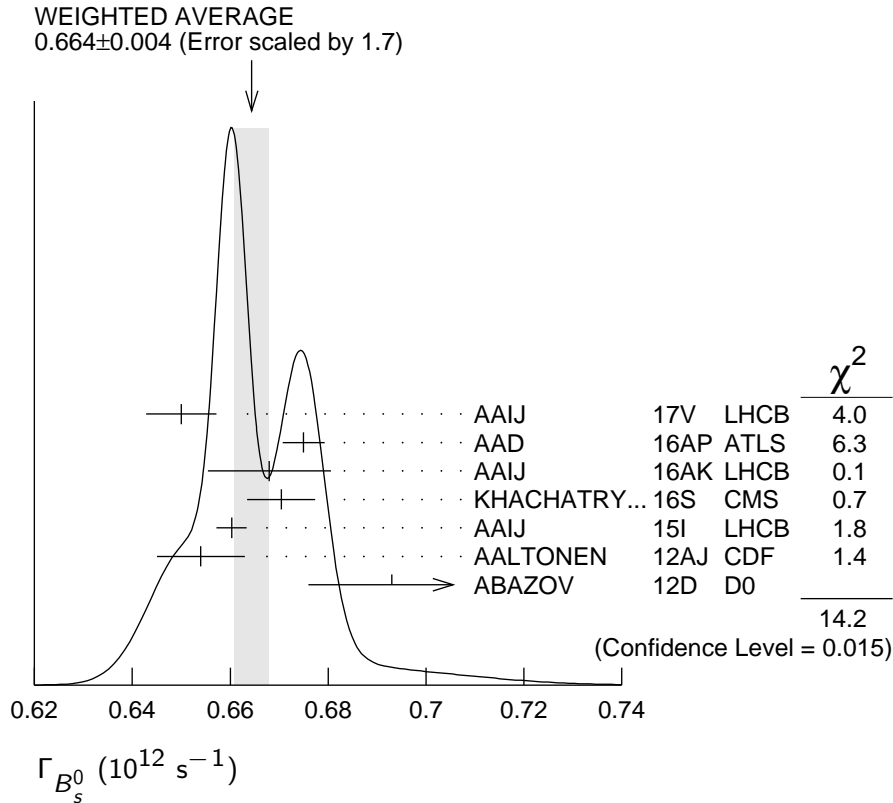
<sup>3</sup> Measured using a time-dependent angular analysis of  $B_s^0 \rightarrow \psi(2S) \phi$  decays.

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

<sup>5</sup> Measured using a combined time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi K^+ K^-$  and  $B_s^0 \rightarrow J/\psi \pi^+ \pi^-$  decays.

<sup>6</sup> Assuming CPV phase  $\phi_s = -0.04$ .

<sup>7</sup> Assuming CPV phase  $\phi_s = 0$ .



$\Delta\Gamma_{B_s^0}$ 

“OUR EVALUATION” is an average performed by the Heavy Flavor Averaging Group (HFLAV) as described in our “Review on  $B$ - $\bar{B}$  Mixing” in the  $B^0$  section of these Listings. It includes the measurements of  $\Gamma_{B_s^0}$  and  $\Delta\Gamma_{B_s^0}$  listed in this section, as well as constraints from effective lifetimes with pure  $CP$  modes and flavor-specific modes.

VALUE ( $10^{12} \text{ s}^{-1}$ )	DOCUMENT ID	TECN	COMMENT
<b>0.088 ± 0.006</b>	<b>OUR EVALUATION</b>		
<b>0.083 ± 0.006</b>	<b>OUR AVERAGE</b>		
0.066 ± 0.018 ± 0.010	<sup>1</sup> AAIJ	17V LHCb	$pp$ at 7, 8 TeV
0.085 ± 0.011 ± 0.007	<sup>2</sup> AAD	16AP ATLAS	$pp$ at 7, 8 TeV
0.066 $^{+0.041}_{-0.044}$ ± 0.007	<sup>3</sup> AAIJ	16AK LHCb	$pp$ at 7, 8 TeV
0.095 ± 0.013 ± 0.007	<sup>2</sup> KHACHATRYAN	16S CMS	$pp$ at 8 TeV
0.0805 ± 0.0091 ± 0.0032	<sup>4</sup> AAIJ	15I LHCb	$pp$ at 7, 8 TeV
0.068 ± 0.026 ± 0.009	<sup>2</sup> AALTONEN	12AJ CDF	$p\bar{p}$ at 1.96 TeV
0.163 $^{+0.065}_{-0.064}$	<sup>2,5</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.053 ± 0.021 ± 0.010	<sup>2</sup> AAD	14U ATLAS	Repl. by AAD 16AP
0.106 ± 0.011 ± 0.007	<sup>6</sup> AAIJ	13AR LHCb	Repl. by AAIJ 15I
0.053 ± 0.021 ± 0.010	<sup>2</sup> AAD	12CV ATLAS	Repl. by AAD 14U
0.123 ± 0.029 ± 0.011	<sup>2</sup> AAIJ	12D LHCb	Repl. by AAIJ 13AR
0.075 ± 0.035 ± 0.006	<sup>7</sup> AALTONEN	12D CDF	Repl. by AALTONEN 12AJ
0.085 $^{+0.072}_{-0.078}$ ± 0.001	<sup>8</sup> ABAZOV	09E D0	Repl. by ABAZOV 08AM
0.076 $^{+0.059}_{-0.063}$ ± 0.006	<sup>9</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
0.19 ± 0.07 $^{+0.02}_{-0.01}$	<sup>2,10</sup> ABAZOV	08AMD0	Repl. by ABAZOV 12D
0.12 $^{+0.08}_{-0.10}$ ± 0.02	<sup>9,11</sup> ABAZOV	07 D0	Repl. by ABAZOV 07N
0.13 ± 0.09	<sup>12</sup> ABAZOV	07N D0	Repl. by ABAZOV 09E
0.47 $^{+0.19}_{-0.24}$ ± 0.01	<sup>9</sup> ACOSTA	05 CDF	Repl. by AALTONEN 08J

<sup>1</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi K^+ K^-$  in the region  $m(KK) > 1.05 \text{ GeV}$ .

<sup>2</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.

<sup>3</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow \psi(2S) \phi$  decays.

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

<sup>5</sup> The error includes both statistical and systematic uncertainties.

<sup>6</sup> AAIJ 13AR result comes from a combined fit to  $B_s^0 \rightarrow J/\psi K^+ K^-$  and  $B_s^0 \rightarrow J/\psi \pi^+ \pi^-$  data sets. Also reports  $\Delta\Gamma_s = 0.100 \pm 0.016 \pm 0.003 \text{ ps}^{-1}$  from a fit to  $B_s^0 \rightarrow J/\psi K^+ K^-$  decays.

<sup>7</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>8</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>9</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>10</sup> Obtains 90% CL interval  $-0.06 < \Delta\Gamma_s < 0.30$ .
- <sup>11</sup> ABAZOV 07 reports  $0.17 \pm 0.09 \pm 0.02$  with  $CP$ -violating phase  $\phi_s$  as a free parameter.
- <sup>12</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.

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

$\Gamma_{B_s^0}$  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 provided by the Heavy Flavor Averaging Group (HFLAV). It is derived from the averages of  $\Gamma_{B_s^0}$  and  $\Delta\Gamma_{B_s^0}$  (and their correlation).

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>0.132±0.008 OUR EVALUATION</b>				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.090±0.009±0.023		<sup>1</sup> ESEN	13 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
		<sup>2</sup> AAIJ	12D LHCB	$pp$ at 7 TeV
		<sup>3</sup> AALTONEN	12D CDF	$p\bar{p}$ at 1.96 TeV
		<sup>4</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV
0.147 <sup>+0.036+0.042</sup> <sub>-0.030-0.041</sub>		<sup>1</sup> ESEN	10 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
0.072±0.021±0.022		<sup>5</sup> ABAZOV	09I D0	$p\bar{p}$ at 1.96 TeV
>0.012	95	<sup>5</sup> AALTONEN	08F CDF	$p\bar{p}$ at 1.96 TeV
0.116 <sup>+0.09</sup> <sub>-0.10</sub> ±0.010		<sup>6</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
0.079 <sup>+0.038+0.031</sup> <sub>-0.035-0.030</sub>		<sup>5</sup> ABAZOV	07Y D0	Repl. by ABAZOV 09I
0.24 <sup>+0.28+0.03</sup> <sub>-0.38-0.04</sub>		<sup>6,7</sup> ABAZOV	05W D0	Repl. by ABAZOV 08AM
0.65 <sup>+0.25</sup> <sub>-0.33</sub> ±0.01		<sup>6</sup> ACOSTA	05 CDF	Repl. by AALTONEN 08J
<0.46	95	<sup>8</sup> ABREU	00Y DLPH	$e^+e^- \rightarrow Z$
<0.69	95	<sup>9</sup> ABREU,P	00G DLPH	$e^+e^- \rightarrow Z$
0.25 <sup>+0.21</sup> <sub>-0.14</sub>		<sup>10</sup> BARATE	00K ALEP	$e^+e^- \rightarrow Z$
<0.83	95	<sup>11</sup> ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
<0.67	95	<sup>12</sup> ACCIARRI	98S L3	$e^+e^- \rightarrow Z$

<sup>1</sup> Assumes  $CP$  violation is negligible.

<sup>2</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.

<sup>3</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>4</sup> Measured using fully reconstructed  $B_s \rightarrow J/\psi \phi$  decays.

<sup>5</sup> Assumes  $2 B(B_s^0 \rightarrow D_s^{(*)} D_s^{(*)}) \simeq \Delta\Gamma_s^{CP} / \Gamma_s$ .

<sup>6</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.

<sup>7</sup> Uses  $|A_0|^2 - |A_{\parallel}|^2 = 0.355 \pm 0.066$  from ACOSTA 05.

<sup>8</sup> Uses  $D_s^- \ell^+$ , and  $\phi \ell^+$  vertices.

<sup>9</sup> Measured using  $D_s$  hadron vertices.

<sup>10</sup> Uses  $\phi \phi$  correlations from  $B_s^0 \rightarrow D_s^{(*)+} D_s^{(*)-}$ .

<sup>11</sup> ABE 99D assumes  $\tau_{B_s^0} = 1.55 \pm 0.05$  ps.

<sup>12</sup> ACCIARRI 98S assumes  $\tau_{B_s^0} = 1.49 \pm 0.06$  ps and PDG 98 values of  $b$  production fraction.

## $B_{sH}^0$ MEAN LIFE

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

"OUR EVALUATION" is provided by the Heavy Flavor Averaging Group (HFLAV). It is derived from the averages of  $\Gamma_{B_s^0}$  and  $\Delta\Gamma_{B_s^0}$  (and their correlation).

VALUE ( $10^{-12}$ s)	DOCUMENT ID	TECN	COMMENT
<b>1.615 ± 0.009 OUR EVALUATION</b>			
<b>2.04 ± 0.44 ± 0.05</b>	<sup>1</sup> AAIJ	17AI LHCB	$p\bar{p}$ at 7, 8, 13 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.70 ± 0.14 ± 0.05	<sup>2</sup> ABAZOV	16C D0	$p\bar{p}$ at 1.96 TeV
1.75 ± 0.12 ± 0.07	<sup>3</sup> AAIJ	13AB LHCB	$p\bar{p}$ at 7 TeV
1.652 ± 0.024 ± 0.024	<sup>4</sup> AAIJ	13AR LHCB	$p\bar{p}$ at 7 TeV
1.700 ± 0.040 ± 0.026	<sup>5</sup> AAIJ	12AN LHCB	$p\bar{p}$ at 7 TeV
	<sup>6</sup> AALTONEN	12D CDF	$p\bar{p}$ at 1.96 TeV
1.70 <sup>+0.12</sup> <sub>-0.11</sub> ± 0.03	<sup>5</sup> AALTONEN	11AB CDF	$p\bar{p}$ at 1.96 TeV
1.613 <sup>+0.123</sup> <sub>-0.113</sub>	<sup>7,8</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
1.58 <sup>+0.39</sup> <sub>-0.42</sub> <sup>+0.01</sup> <sub>-0.02</sub>	<sup>8</sup> ABAZOV	05W D0	Repl. by ABAZOV 08AM
2.07 <sup>+0.58</sup> <sub>-0.46</sub> ± 0.03	<sup>8</sup> ACOSTA	05 CDF	Repl. by AALTONEN 08J

<sup>1</sup> Measured using  $B_s \rightarrow \mu^+ \mu^-$  decays which, in the Standard Model, correspond to  $B_{sH}^0$  decays. Assumes  $-2 \operatorname{Re}(\lambda)/(1 + |\lambda|^2) = 1$ .

<sup>2</sup> Measured using  $J/\psi \pi^+ \pi^-$  mode with  $0.880 < m(\pi\pi) < 1.080$  GeV/ $c^2$ , which is mostly  $J/\psi f(0)(980)$  mode, a pure  $CP$ -odd final state.

<sup>3</sup> Measured using a pure  $CP$ -odd final state  $J/\psi K_S^0$  with the assumption that contributions from penguin diagrams are small.

<sup>4</sup> Measured using  $B_s \rightarrow J/\psi \pi^+ \pi^-$  decays which, in the limit of  $\phi_s = 0$  and  $|\lambda| = 1$ , correspond to  $B_{sH}^0$  decays.

<sup>5</sup> Measured using a pure  $CP$ -odd final state  $J/\psi f_0(980)$ .

<sup>6</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>7</sup> Obtained from  $\Delta\Gamma_s$  and  $\Gamma_s$  fit with a correlation of 0.6.

<sup>8</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" is provided by the Heavy Flavor Averaging Group (HFLAV). It is derived from the averages of  $\Gamma_{B_s^0}$  and  $\Delta\Gamma_{B_s^0}$  (and their correlation).

VALUE ( $10^{-12}$ s)	DOCUMENT ID	TECN	COMMENT
-----------------------	-------------	------	---------

### 1.415 ± 0.006 OUR EVALUATION

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

1.479 ± 0.034 ± 0.011	<sup>1</sup> AAIJ	16AL LHCb	$pp$ at 7, 8 TeV
1.379 ± 0.026 ± 0.017	<sup>2</sup> AAIJ	14F LHCb	$pp$ at 7, 8 TeV
1.407 ± 0.016 ± 0.007	<sup>3</sup> AAIJ	14R LHCb	$pp$ at 7 TeV
1.440 ± 0.096 ± 0.009	<sup>3</sup> AAIJ	12 LHCb	Repl. by AAIJ 14R
1.455 ± 0.046 ± 0.006	<sup>3</sup> AAIJ	12R LHCb	Repl. by AAIJ 14R
	<sup>4</sup> AALTONEN	12D CDF	$p\bar{p}$ at 1.96 TeV
1.437 <sup>+0.054</sup> <sub>-0.047</sub>	<sup>5,6</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
1.24 <sup>+0.14</sup> <sub>-0.11</sub> <sup>+0.01</sup> <sub>-0.02</sub>	<sup>6</sup> ABAZOV	05W D0	Repl. by ABAZOV 08AM
1.05 <sup>+0.16</sup> <sub>-0.13</sub> ± 0.02	<sup>6</sup> ACOSTA	05 CDF	Repl. by AALTONEN 08J
1.27 ± 0.33 ± 0.08	<sup>7</sup> BARATE	00K ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> Measured using  $B_s^0 \rightarrow J/\psi\eta$  decays.

<sup>2</sup> Measured using  $B_s^0 \rightarrow D_s^- D_s^+$ . The effective lifetime is translated into a decay width of  $\Gamma_L = 0.725 \pm 0.014 \pm 0.009$  ps<sup>-1</sup>.

<sup>3</sup> Measured using  $B_s^0 \rightarrow K^+ K^-$  decays. There may still be CPV in the decay.

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

<sup>6</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>7</sup> Uses  $\phi\phi$  correlations from  $B_s^0 \rightarrow D_s^{(*)+} D_s^{(*)-}$ .

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

VALUE ( $10^{-12}$ s)	DOCUMENT ID	TECN	COMMENT
-----------------------	-------------	------	---------

### 1.527 ± 0.011 OUR EVALUATION

**1.526 ± 0.015 OUR AVERAGE** Error includes scale factor of 1.3. See the ideogram below.

1.547 ± 0.013 ± 0.011	<sup>1</sup> AAIJ	17AN LHCb	$pp$ at 7, 8 TeV
1.479 ± 0.010 ± 0.021	<sup>2</sup> ABAZOV	15A D0	$p\bar{p}$ at 1.96 TeV
1.535 ± 0.015 ± 0.014	<sup>3</sup> AAIJ	14AX LHCb	$pp$ at 7 TeV
1.52 ± 0.15 ± 0.01	<sup>4</sup> AAIJ	14F LHCb	$pp$ at 7, 8 TeV
1.60 ± 0.06 ± 0.01	<sup>5</sup> AAIJ	14R LHCb	$pp$ at 7 TeV



$1.518 \pm 0.041 \pm 0.027$	<sup>6</sup> AALTONEN	11AP CDF	$\rho\bar{p}$ at 1.96 TeV
$1.42^{+0.14}_{-0.13} \pm 0.03$	<sup>7</sup> ABREU	00Y DLPH	$e^+e^- \rightarrow Z$
$1.36 \pm 0.09^{+0.06}_{-0.05}$	<sup>8</sup> ABE	99D CDF	$\rho\bar{p}$ at 1.8 TeV
$1.50^{+0.16}_{-0.15} \pm 0.04$	<sup>8</sup> ACKERSTAFF	98G OPAL	$e^+e^- \rightarrow Z$
$1.54^{+0.14}_{-0.13} \pm 0.04$	<sup>8</sup> BUSKULIC	96M ALEP	$e^+e^- \rightarrow Z$

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

$1.398 \pm 0.044^{+0.028}_{-0.025}$	<sup>9</sup> ABAZOV	06V D0	Repl. by ABAZOV 15A
-------------------------------------	---------------------	--------	---------------------

<sup>1</sup> AAIJ 17AN value was measured using  $B_s^0 \rightarrow D_s^{(*)-} \mu^+ \nu_\mu$  decays relative to  $B^0 \rightarrow D^{(*)-} \mu^+ \nu_\mu$  decays.

<sup>2</sup> Measured using  $B_s^0 \rightarrow D_s^- \mu^+ \nu_\mu X$  decays.

<sup>3</sup> Measured using the  $B_s^0 \rightarrow D_s^- \pi^+$  decays.

<sup>4</sup> Measured using  $B_s^0 \rightarrow D^+ D_s^-$ .

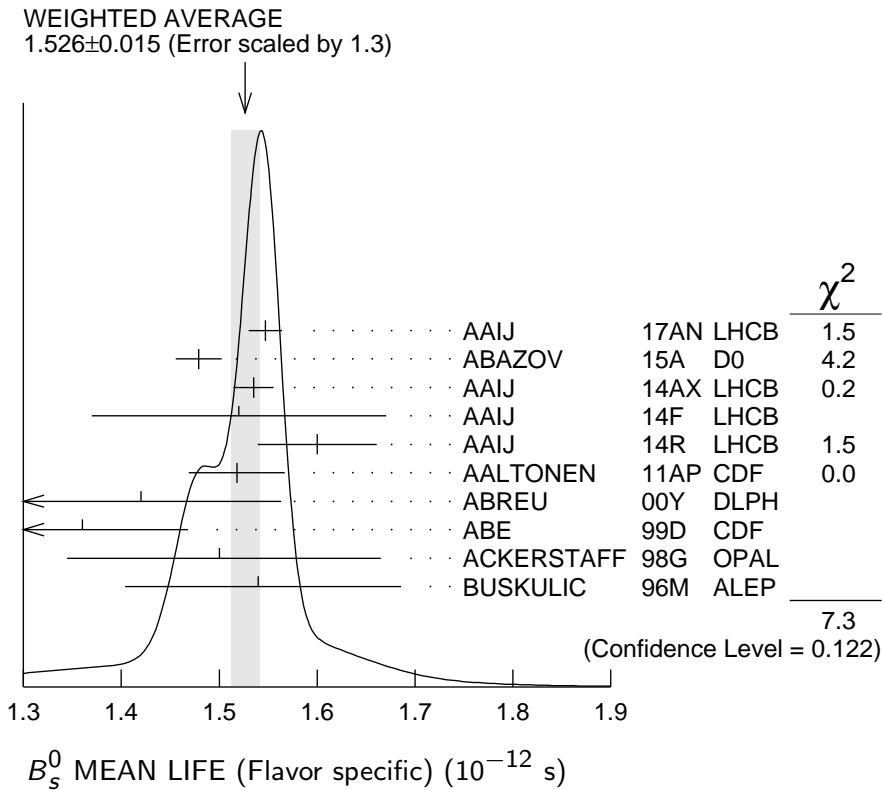
<sup>5</sup> Measured using  $B_s^0 \rightarrow \pi^+ K^-$  decays.

<sup>6</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>7</sup> Uses  $D_s^- \ell^+$ , and  $\phi \ell^+$  vertices.

<sup>8</sup> Measured using  $D_s^- \ell^+$  vertices.

<sup>9</sup> Measured using  $D_s^- \mu^+$  vertices.



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

VALUE ( $10^{-12}$ s)	DOCUMENT ID	TECN	COMMENT
<b><math>1.479 \pm 0.012</math> OUR EVALUATION</b>			
<b><math>1.479 \pm 0.012</math> OUR AVERAGE</b>			
$1.480 \pm 0.011 \pm 0.005$	<sup>1</sup> AAIJ	14E LHCB	$p\bar{p}$ at 7 TeV
$1.444^{+0.098}_{-0.090} \pm 0.020$	<sup>1</sup> ABAZOV	05B D0	$p\bar{p}$ at 1.96 TeV
$1.34^{+0.23}_{-0.19} \pm 0.05$	<sup>2</sup> ABE	98B CDF	$p\bar{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.39^{+0.13}_{-0.16}^{+0.01}_{-0.02}$	<sup>2</sup> ABAZOV	05W D0	$p\bar{p}$ at 1.96 TeV
$1.34^{+0.23}_{-0.19} \pm 0.05$	<sup>3</sup> ABE	96N CDF	Repl. by ABE 98B
<sup>1</sup> Measured using fully reconstructed $B_s \rightarrow J/\psi\phi$ decays.			
<sup>2</sup> Measured using the time-dependent angular analysis of $B_s^0 \rightarrow J/\psi\phi$ decays.			
<sup>3</sup> ABE 96N uses $58 \pm 12$ exclusive $B_s \rightarrow J/\psi\phi$ events.			

 **$B_s^0$  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
$\Gamma_1$ $D_s^- \text{ anything}$	(93 $\pm$ 25 ) %	
$\Gamma_2$ $\ell \nu_\ell X$	( 9.6 $\pm$ 0.8 ) %	
$\Gamma_3$ $e^+ \nu X^-$	( 9.1 $\pm$ 0.8 ) %	
$\Gamma_4$ $\mu^+ \nu X^-$	(10.2 $\pm$ 1.0 ) %	
$\Gamma_5$ $D_s^- \ell^+ \nu_\ell \text{ anything}$	[a] ( 8.1 $\pm$ 1.3 ) %	
$\Gamma_6$ $D_s^{*-} \ell^+ \nu_\ell \text{ anything}$	( 5.4 $\pm$ 1.1 ) %	
$\Gamma_7$ $D_{s1}(2536)^- \mu^+ \nu_\mu, D_{s1}^- \rightarrow D_s^{*-} K_S^0$	( 2.6 $\pm$ 0.7 ) $\times 10^{-3}$	
$\Gamma_8$ $D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+$	( 4.4 $\pm$ 1.3 ) $\times 10^{-3}$	
$\Gamma_9$ $D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+$	( 2.7 $\pm$ 1.0 ) $\times 10^{-3}$	
$\Gamma_{10}$ $D_s^- \pi^+$	( 3.00 $\pm$ 0.23 ) $\times 10^{-3}$	

$\Gamma_{11}$	$D_s^- \rho^+$	$( 6.9 \pm 1.4 ) \times 10^{-3}$	
$\Gamma_{12}$	$D_s^- \pi^+ \pi^+ \pi^-$	$( 6.1 \pm 1.0 ) \times 10^{-3}$	
$\Gamma_{13}$	$D_{s1}(2536)^- \pi^+, D_{s1}^- \rightarrow D_s^- \pi^+ \pi^-$	$( 2.5 \pm 0.8 ) \times 10^{-5}$	
$\Gamma_{14}$	$D_s^\mp K^\pm$	$( 2.27 \pm 0.19 ) \times 10^{-4}$	
$\Gamma_{15}$	$D_s^- K^+ \pi^+ \pi^-$	$( 3.2 \pm 0.6 ) \times 10^{-4}$	
$\Gamma_{16}$	$D_s^+ D_s^-$	$( 4.4 \pm 0.5 ) \times 10^{-3}$	
$\Gamma_{17}$	$D_s^- D^+$	$( 2.8 \pm 0.5 ) \times 10^{-4}$	
$\Gamma_{18}$	$D^+ D^-$	$( 2.2 \pm 0.6 ) \times 10^{-4}$	
$\Gamma_{19}$	$D^0 \bar{D}^0$	$( 1.9 \pm 0.5 ) \times 10^{-4}$	
$\Gamma_{20}$	$D_s^{*-} \pi^+$	$( 2.0 \pm 0.5 ) \times 10^{-3}$	
$\Gamma_{21}$	$D_s^{*\mp} K^\pm$	$( 1.33 \pm 0.35 ) \times 10^{-4}$	
$\Gamma_{22}$	$D_s^{*-} \rho^+$	$( 9.6 \pm 2.1 ) \times 10^{-3}$	
$\Gamma_{23}$	$D_s^{*+} D_s^- + D_s^{*-} D_s^+$	$( 1.38 \pm 0.16 ) \%$	
$\Gamma_{24}$	$D_s^{*+} D_s^{*-}$	$( 1.44 \pm 0.20 ) \%$	S=1.1
$\Gamma_{25}$	$D_s^{(*)+} D_s^{(*)-}$	$( 4.5 \pm 1.4 ) \%$	
$\Gamma_{26}$	$\bar{D}^{*0} \bar{K}^0$	$( 2.8 \pm 1.1 ) \times 10^{-4}$	
$\Gamma_{27}$	$\bar{D}^0 \bar{K}^0$	$( 4.3 \pm 0.9 ) \times 10^{-4}$	
$\Gamma_{28}$	$\bar{D}^0 K^- \pi^+$	$( 1.04 \pm 0.13 ) \times 10^{-3}$	
$\Gamma_{29}$	$\bar{D}^0 \bar{K}^*(892)^0$	$( 4.4 \pm 0.6 ) \times 10^{-4}$	
$\Gamma_{30}$	$\bar{D}^0 \bar{K}^*(1410)$	$( 3.9 \pm 3.5 ) \times 10^{-4}$	
$\Gamma_{31}$	$\bar{D}^0 \bar{K}_0^*(1430)$	$( 3.0 \pm 0.7 ) \times 10^{-4}$	
$\Gamma_{32}$	$\bar{D}^0 \bar{K}_2^*(1430)$	$( 1.1 \pm 0.4 ) \times 10^{-4}$	
$\Gamma_{33}$	$\bar{D}^0 \bar{K}^*(1680)$	$< 7.8 \times 10^{-5}$	CL=90%
$\Gamma_{34}$	$\bar{D}^0 \bar{K}_0^*(1950)$	$< 1.1 \times 10^{-4}$	CL=90%
$\Gamma_{35}$	$\bar{D}^0 \bar{K}_3^*(1780)$	$< 2.6 \times 10^{-5}$	CL=90%
$\Gamma_{36}$	$\bar{D}^0 \bar{K}_4^*(2045)$	$< 3.1 \times 10^{-5}$	CL=90%
$\Gamma_{37}$	$\bar{D}^0 K^- \pi^+$ (non-resonant)	$( 2.1 \pm 0.8 ) \times 10^{-4}$	
$\Gamma_{38}$	$D_{s2}^*(2573)^- \pi^+, D_{s2}^* \rightarrow \bar{D}^0 K^-$	$( 2.6 \pm 0.4 ) \times 10^{-4}$	
$\Gamma_{39}$	$D_{s1}^*(2700)^- \pi^+, D_{s1}^* \rightarrow \bar{D}^0 K^-$	$( 1.6 \pm 0.8 ) \times 10^{-5}$	
$\Gamma_{40}$	$D_{s1}^*(2860)^- \pi^+, D_{s1}^* \rightarrow \bar{D}^0 K^-$	$( 5 \pm 4 ) \times 10^{-5}$	
$\Gamma_{41}$	$D_{s3}^*(2860)^- \pi^+, D_{s3}^* \rightarrow \bar{D}^0 K^-$	$( 2.2 \pm 0.6 ) \times 10^{-5}$	
$\Gamma_{42}$	$\bar{D}^0 K^+ K^-$	$( 4.4 \pm 2.0 ) \times 10^{-5}$	
$\Gamma_{43}$	$\bar{D}^0 f_0(980)$	$< 3.1 \times 10^{-6}$	CL=90%
$\Gamma_{44}$	$\bar{D}^0 \phi$	$( 3.0 \pm 0.8 ) \times 10^{-5}$	
$\Gamma_{45}$	$D^{*\mp} \pi^\pm$	$< 6.1 \times 10^{-6}$	CL=90%
$\Gamma_{46}$	$\eta_c \phi$	$( 5.0 \pm 0.9 ) \times 10^{-4}$	
$\Gamma_{47}$	$\eta_c \pi^+ \pi^-$	$( 1.8 \pm 0.7 ) \times 10^{-4}$	

$\Gamma_{48}$	$J/\psi(1S)\phi$	$(1.08 \pm 0.08) \times 10^{-3}$	
$\Gamma_{49}$	$J/\psi(1S)\phi\phi$	$(1.24^{+0.17}_{-0.19}) \times 10^{-5}$	
$\Gamma_{50}$	$J/\psi(1S)\pi^0$	$< 1.2 \times 10^{-3}$	CL=90%
$\Gamma_{51}$	$J/\psi(1S)\eta$	$(4.0 \pm 0.7) \times 10^{-4}$	S=1.4
$\Gamma_{52}$	$J/\psi(1S)K_S^0$	$(1.88 \pm 0.15) \times 10^{-5}$	
$\Gamma_{53}$	$J/\psi(1S)\bar{K}^*(892)^0$	$(4.1 \pm 0.4) \times 10^{-5}$	
$\Gamma_{54}$	$J/\psi(1S)\eta'$	$(3.3 \pm 0.4) \times 10^{-4}$	
$\Gamma_{55}$	$J/\psi(1S)\pi^+\pi^-$	$(2.09 \pm 0.23) \times 10^{-4}$	S=1.3
$\Gamma_{56}$	$J/\psi(1S)f_0(500), f_0 \rightarrow \pi^+\pi^-$	$< 4 \times 10^{-6}$	CL=90%
$\Gamma_{57}$	$J/\psi(1S)\rho, \rho \rightarrow \pi^+\pi^-$	$< 4 \times 10^{-6}$	CL=90%
$\Gamma_{58}$	$J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-$	$(1.28 \pm 0.18) \times 10^{-4}$	S=1.7
$\Gamma_{59}$	$J/\psi(1S)f_2(1270), f_2 \rightarrow \pi^+\pi^-$	$(1.1 \pm 0.4) \times 10^{-6}$	
$\Gamma_{60}$	$J/\psi(1S)f_2(1270)_0, f_2 \rightarrow \pi^+\pi^-$	$(7.5 \pm 1.8) \times 10^{-7}$	
$\Gamma_{61}$	$J/\psi(1S)f_2(1270)_{  }, f_2 \rightarrow \pi^+\pi^-$	$(1.09 \pm 0.34) \times 10^{-6}$	
$\Gamma_{62}$	$J/\psi(1S)f_2(1270)_{\perp}, f_2 \rightarrow \pi^+\pi^-$	$(1.3 \pm 0.8) \times 10^{-6}$	
$\Gamma_{63}$	$J/\psi(1S)f_0(1370), f_0 \rightarrow \pi^+\pi^-$	$(4.5^{+0.7}_{-4.0}) \times 10^{-5}$	
$\Gamma_{64}$	$J/\psi(1S)f_0(1500), f_0 \rightarrow \pi^+\pi^-$	$(2.11^{+0.40}_{-0.29}) \times 10^{-5}$	
$\Gamma_{65}$	$J/\psi(1S)f'_2(1525)_0, f'_2 \rightarrow \pi^+\pi^-$	$(1.07 \pm 0.24) \times 10^{-6}$	
$\Gamma_{66}$	$J/\psi(1S)f'_2(1525)_{  }, f'_2 \rightarrow \pi^+\pi^-$	$(1.3^{+2.7}_{-0.9}) \times 10^{-7}$	
$\Gamma_{67}$	$J/\psi(1S)f'_2(1525)_{\perp}, f'_2 \rightarrow \pi^+\pi^-$	$(5 \pm 4) \times 10^{-7}$	
$\Gamma_{68}$	$J/\psi(1S)f_0(1790), f_0 \rightarrow \pi^+\pi^-$	$(5.0^{+11.0}_{-1.1}) \times 10^{-6}$	
$\Gamma_{69}$	$J/\psi(1S)\pi^+\pi^-$ (nonresonant)	$(1.8^{+1.1}_{-0.4}) \times 10^{-5}$	
$\Gamma_{70}$	$J/\psi(1S)\bar{K}^0\pi^+\pi^-$	$< 4.4 \times 10^{-5}$	CL=90%
$\Gamma_{71}$	$J/\psi(1S)K^+K^-$	$(7.9 \pm 0.7) \times 10^{-4}$	
$\Gamma_{72}$	$J/\psi(1S)K^0K^-\pi^+ + \text{c.c.}$	$(9.3 \pm 1.3) \times 10^{-4}$	
$\Gamma_{73}$	$J/\psi(1S)\bar{K}^0K^+K^-$	$< 1.2 \times 10^{-5}$	CL=90%
$\Gamma_{74}$	$J/\psi(1S)f'_2(1525)$	$(2.6 \pm 0.6) \times 10^{-4}$	
$\Gamma_{75}$	$J/\psi(1S)p\bar{p}$	$< 4.8 \times 10^{-6}$	CL=90%
$\Gamma_{76}$	$J/\psi(1S)\gamma$	$< 7.3 \times 10^{-6}$	CL=90%
$\Gamma_{77}$	$J/\psi(1S)\pi^+\pi^-\pi^+\pi^-$	$(7.8 \pm 1.0) \times 10^{-5}$	
$\Gamma_{78}$	$J/\psi(1S)f_1(1285)$	$(7.0 \pm 1.4) \times 10^{-5}$	

$\Gamma_{79}$	$\psi(2S)\eta$	$(3.3 \pm 0.9) \times 10^{-4}$	
$\Gamma_{80}$	$\psi(2S)\eta'$	$(1.29 \pm 0.35) \times 10^{-4}$	
$\Gamma_{81}$	$\psi(2S)\pi^+\pi^-$	$(7.1 \pm 1.3) \times 10^{-5}$	
$\Gamma_{82}$	$\psi(2S)\phi$	$(5.4 \pm 0.6) \times 10^{-4}$	
$\Gamma_{83}$	$\psi(2S)K^-\pi^+$	$(3.12 \pm 0.30) \times 10^{-5}$	
$\Gamma_{84}$	$\psi(2S)\bar{K}^*(892)^0$	$(3.3 \pm 0.5) \times 10^{-5}$	
$\Gamma_{85}$	$\chi_{c1}\phi$	$(2.04 \pm 0.30) \times 10^{-4}$	
$\Gamma_{86}$	$\pi^+\pi^-$	$(7.0 \pm 0.8) \times 10^{-7}$	
$\Gamma_{87}$	$\pi^0\pi^0$	$< 2.1 \times 10^{-4}$	CL=90%
$\Gamma_{88}$	$\eta\pi^0$	$< 1.0 \times 10^{-3}$	CL=90%
$\Gamma_{89}$	$\eta\eta$	$< 1.5 \times 10^{-3}$	CL=90%
$\Gamma_{90}$	$\rho^0\rho^0$	$< 3.20 \times 10^{-4}$	CL=90%
$\Gamma_{91}$	$\eta'\eta'$	$(3.3 \pm 0.7) \times 10^{-5}$	
$\Gamma_{92}$	$\eta'\phi$	$< 8.2 \times 10^{-7}$	CL=90%
$\Gamma_{93}$	$\phi f_0(980), f_0(980) \rightarrow \pi^+\pi^-$	$(1.12 \pm 0.21) \times 10^{-6}$	
$\Gamma_{94}$	$\phi f_2(1270), f_2(1270) \rightarrow \pi^+\pi^-$	$(6.1 \pm_{-1.5}^{+1.8}) \times 10^{-7}$	
$\Gamma_{95}$	$\phi\rho^0$	$(2.7 \pm 0.8) \times 10^{-7}$	
$\Gamma_{96}$	$\phi\pi^+\pi^-$	$(3.5 \pm 0.5) \times 10^{-6}$	
$\Gamma_{97}$	$\phi\phi$	$(1.87 \pm 0.15) \times 10^{-5}$	
$\Gamma_{98}$	$\phi\phi\phi$	$(2.2 \pm 0.7) \times 10^{-6}$	
$\Gamma_{99}$	$\pi^+K^-$	$(5.7 \pm 0.6) \times 10^{-6}$	
$\Gamma_{100}$	$K^+K^-$	$(2.59 \pm 0.17) \times 10^{-5}$	
$\Gamma_{101}$	$K^0\bar{K}^0$	$(2.0 \pm 0.6) \times 10^{-5}$	
$\Gamma_{102}$	$K^0\pi^+\pi^-$	$(9.4 \pm 2.1) \times 10^{-6}$	
$\Gamma_{103}$	$K^0K^\pm\pi^\mp$	$(8.4 \pm 0.9) \times 10^{-5}$	
$\Gamma_{104}$	$K^*(892)^-\pi^+$	$(3.3 \pm 1.2) \times 10^{-6}$	
$\Gamma_{105}$	$K^*(892)^\pm K^\mp$	$(1.25 \pm 0.26) \times 10^{-5}$	
$\Gamma_{106}$	$K_S^0\bar{K}^*(892)^0 + c.c.$	$(1.6 \pm 0.4) \times 10^{-5}$	
$\Gamma_{107}$	$K^0K^+K^-$	$(1.3 \pm 0.6) \times 10^{-6}$	
$\Gamma_{108}$	$\bar{K}^*(892)^0\rho^0$	$< 7.67 \times 10^{-4}$	CL=90%
$\Gamma_{109}$	$\bar{K}^*(892)^0K^*(892)^0$	$(1.11 \pm 0.27) \times 10^{-5}$	
$\Gamma_{110}$	$\phi K^*(892)^0$	$(1.14 \pm 0.30) \times 10^{-6}$	
$\Gamma_{111}$	$p\bar{p}$	$< 1.5 \times 10^{-8}$	CL=90%
$\Gamma_{112}$	$p\bar{p}K^+K^-$	$(4.5 \pm 0.5) \times 10^{-6}$	
$\Gamma_{113}$	$p\bar{p}K^+\pi^-$	$(1.39 \pm 0.26) \times 10^{-6}$	
$\Gamma_{114}$	$p\bar{p}\pi^+\pi^-$	$(4.3 \pm 2.0) \times 10^{-7}$	
$\Gamma_{115}$	$p\bar{p}\Lambda K^- + c.c.$	$(5.5 \pm 1.0) \times 10^{-6}$	
$\Gamma_{116}$	$\Lambda_c^-\Lambda\pi^+$	$(3.6 \pm 1.6) \times 10^{-4}$	
$\Gamma_{117}$	$\Lambda_c^-\Lambda_c^+$	$< 8.0 \times 10^{-5}$	CL=95%

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

$\Gamma_{118}$	$\gamma\gamma$	<i>B1</i>	$< 3.1$	$\times 10^{-6}$	CL=90%
$\Gamma_{119}$	$\phi\gamma$	<i>B1</i>	$( 3.4 \pm 0.4 )$	$\times 10^{-5}$	
$\Gamma_{120}$	$\mu^+ \mu^-$	<i>B1</i>	$( 2.7 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.6 \\ 0.5 \end{smallmatrix} )$	$\times 10^{-9}$	S=1.2
$\Gamma_{121}$	$e^+ e^-$	<i>B1</i>	$< 2.8$	$\times 10^{-7}$	CL=90%
$\Gamma_{122}$	$\tau^+ \tau^-$	<i>B1</i>	$< 6.8$	$\times 10^{-3}$	CL=95%
$\Gamma_{123}$	$\mu^+ \mu^- \mu^+ \mu^-$	<i>B1</i>	$< 2.5$	$\times 10^{-9}$	CL=95%
$\Gamma_{124}$	$SP, S \rightarrow \mu^+ \mu^-,$ $P \rightarrow \mu^+ \mu^-$	<i>B1</i>	[ <i>b</i> ] $< 2.2$	$\times 10^{-9}$	CL=95%
$\Gamma_{125}$	$\phi(1020)\mu^+ \mu^-$	<i>B1</i>	$( 8.2 \pm 1.2 )$	$\times 10^{-7}$	
$\Gamma_{126}$	$\pi^+ \pi^- \mu^+ \mu^-$	<i>B1</i>	$( 8.4 \pm 1.7 )$	$\times 10^{-8}$	
$\Gamma_{127}$	$\phi\nu\bar{\nu}$	<i>B1</i>	$< 5.4$	$\times 10^{-3}$	CL=90%
$\Gamma_{128}$	$e^\pm \mu^\mp$	<i>LF</i>	[ <i>c</i> ] $< 1.1$	$\times 10^{-8}$	CL=90%

- [a] Not a pure measurement. See note at head of  $B_s^0$  Decay Modes.
- [b] Here *S* and *P* are the hypothetical scalar and pseudoscalar particles with masses of 2.5 GeV/c<sup>2</sup> and 214.3 MeV/c<sup>2</sup>, respectively.
- [c] The value is for the sum of the charge states or particle/antiparticle states indicated.

**CONSTRAINED FIT INFORMATION**

An overall fit to 12 branching ratios uses 20 measurements and one constraint to determine 8 parameters. The overall fit has a  $\chi^2 = 26.7$  for 13 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients  $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$ , 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.

$x_{12}$	28					
$x_{14}$	92	26				
$x_{48}$	0	0	0			
$x_{55}$	0	0	0	72		
$x_{58}$	0	0	0	57	67	
$x_{97}$	0	0	0	29	21	17
	$x_{10}$	$x_{12}$	$x_{14}$	$x_{48}$	$x_{55}$	$x_{58}$

**$B_s^0$  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	$e^+e^- \rightarrow \gamma(4S)$
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  $B(D_s \rightarrow \phi\pi)$ .

 **$\Gamma(\ell\nu_e X)/\Gamma_{\text{total}}$**  **$\Gamma_2/\Gamma$** 

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>9.6±0.8 OUR AVERAGE</b>			
9.6±0.4±0.7	<sup>1</sup> OSWALD 13	BELL	$e^+e^- \rightarrow \gamma(5S)$
9.5 <sup>+2.5+1.1</sup> <sub>-2.0-1.9</sub>	<sup>2</sup> LEES 12A	BABR	$e^+e^-$

<sup>1</sup> The measurement corresponds to the average of the electron and muon branching fractions.

<sup>2</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.

 **$\Gamma(e^+ \nu X^-)/\Gamma_{\text{total}}$**  **$\Gamma_3/\Gamma$** 

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>9.1±0.5±0.6</b>			
	OSWALD 13	BELL	$e^+e^- \rightarrow \gamma(5S)$

 **$\Gamma(\mu^+ \nu X^-)/\Gamma_{\text{total}}$**  **$\Gamma_4/\Gamma$** 

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>10.2±0.6±0.8</b>			
	OSWALD 13	BELL	$e^+e^- \rightarrow \gamma(5S)$

$\Gamma(D_s^- \ell^+ \nu_\ell \text{ anything}) / \Gamma_{\text{total}}$  $\Gamma_5 / \Gamma$ 

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.”

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>8.1±1.3 OUR AVERAGE</b>				
8.2±0.2±1.5		1 OSWALD	15 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
7.6±1.2±2.1	134	2 BUSKULIC	950 ALEP	$e^+e^- \rightarrow Z$
10.7±4.3±2.9		3 ABREU	92M DLPH	$e^+e^- \rightarrow Z$
10.3±3.6±2.8	18	4 ACTON	92N OPAL	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
13 ±4 ±4	27	5 BUSKULIC	92E ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> Obtains  $B_s \rightarrow D_s X e \nu$ , and  $D_s X \mu \nu$  separately, then combines them by assuming systematic uncertainties are fully correlated, except for the one on lepton identification. The third uncertainty adds in quadrature systematic uncertainties from external sources (number of  $B_s$  events, and  $D_s^{(*)}$  branching fractions). OSWALD 15 also measures the cross-section  $\sigma(e^+e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = 53.8 \pm 1.4 \pm 5.3$  pb at  $\sqrt{s} = 10.86$  GeV.

<sup>2</sup> BUSKULIC 950 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>3</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>4</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>5</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 950.



$\Gamma(D_s^{*-} \ell^+ \nu_\ell \text{ anything})/\Gamma_{\text{total}}$   $\Gamma_6/\Gamma$ 

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>5.4 \pm 0.4 \pm 1.0</math></b>	<sup>1</sup> OSWALD	15	BELL $e^+ e^- \rightarrow \gamma(5S)$

<sup>1</sup> Obtains  $B_s \rightarrow D_s^* X e \nu$ , and  $D_s^* X \mu \nu$  separately, then combines them by assuming systematic uncertainties are fully correlated, except for the one on lepton identification. The third uncertainty adds in quadrature systematic uncertainties from external sources (number of  $B_s$  events, and  $D_s^{(*)}$  branching fractions). OSWALD 15 also measures the cross-section  $\sigma(e^+ e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = 53.8 \pm 1.4 \pm 5.3$  pb at  $\sqrt{s} = 10.86$  GeV.

 $\Gamma(D_{s1}(2536)^- \mu^+ \nu_\mu, D_{s1}^- \rightarrow D^{*-} K_S^0)/\Gamma_{\text{total}}$   $\Gamma_7/\Gamma$ 

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>2.6 \pm 0.7 \pm 0.1</math></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  $B(\bar{b} \rightarrow B_s^0) = (10.1 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+)/\Gamma(D_s^- \ell^+ \nu_\ell \text{ anything})$   $\Gamma_8/\Gamma_5$ 

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

 $\Gamma(D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+)/\Gamma(D_s^- \ell^+ \nu_\ell \text{ anything})$   $\Gamma_9/\Gamma_5$ 

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

 $\Gamma(D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+)/\Gamma(D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+)$   $\Gamma_8/\Gamma_9$ 

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

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

$0.61 \pm 0.14 \pm 0.05$  <sup>1</sup> AAIJ 11A LHCb  $pp$  at 7 TeV

<sup>1</sup> Not independent of other AAIJ 11A measurements.

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

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

**$3.00 \pm 0.23$  OUR FIT**

**$2.99 \pm 0.24$  OUR AVERAGE**

$2.95 \pm 0.05^{+0.25}_{-0.28}$  <sup>1</sup> AAIJ 12AG LHCb  $pp$  at 7 TeV

$3.6 \pm 0.5 \pm 0.5$  <sup>2</sup> LOUVOT 09 BELL  $e^+ e^- \rightarrow \gamma(5S)$

$2.8 \pm 0.6 \pm 0.1$  <sup>3</sup> ABULENCIA 07C CDF  $p\bar{p}$  at 1.96 TeV

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

$6.8 \pm 2.2 \pm 1.6$  DRUTSKOY 07A BELL Repl. by LOUVOT 09

$3.3 \pm 1.1 \pm 0.2$  <sup>4</sup> ABULENCIA 06J CDF Repl. by ABULENCIA 07C

<130 <sup>6</sup> <sup>5</sup> AKERS 94J OPAL  $e^+ e^- \rightarrow Z$

seen <sup>1</sup> BUSKULIC 93G ALEP  $e^+ e^- \rightarrow Z$

- <sup>1</sup> AAIJ 12AG reports  $(2.95 \pm 0.05 \pm 0.17_{-0.22}^{+0.18}) \times 10^{-3}$  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  $(3.67_{-0.33}^{+0.35+0.65}) \times 10^{-3}$  from a measurement of  $[\Gamma(B_s^0 \rightarrow D_s^- \pi^+)/\Gamma_{\text{total}}] \times [B(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)})]$  assuming  $B(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (19.5 \pm 2.6) \times 10^{-2}$ , which we rescale to our best value  $B(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (20.1 \pm 3.1) \times 10^{-2}$ . 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  $B(B^0 \rightarrow D^- \pi^+) = (2.52 \pm 0.13) \times 10^{-3}$ . 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  $B(B^0 \rightarrow D^- \pi^+) = (2.52 \pm 0.13) \times 10^{-3}$ . 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  $B(\bar{b} \rightarrow B_s^0) = 0.105$ .

$\Gamma(D_s^- \rho^+)/\Gamma_{\text{total}}$   $\Gamma_{11}/\Gamma$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>6.9±1.3±0.5</b>	<sup>1</sup> LOUVOT	10	BELL $e^+ e^- \rightarrow \Upsilon(5S)$

<sup>1</sup> LOUVOT 10 reports  $[\Gamma(B_s^0 \rightarrow D_s^- \rho^+)/\Gamma_{\text{total}}] / [B(B_s^0 \rightarrow D_s^- \pi^+)] = 2.3 \pm 0.4 \pm 0.2$  which we multiply by our best value  $B(B_s^0 \rightarrow D_s^- \pi^+) = (3.00 \pm 0.23) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^- \pi^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{12}/\Gamma$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>6.1±1.0 OUR FIT</b>			
<b>6.3±1.5±0.7</b>	<sup>1</sup> ABULENCIA	07C	CDF $p\bar{p}$ 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  $B(B^0 \rightarrow D^- \pi^+ \pi^+ \pi^-) = (6.0 \pm 0.7) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^- \pi^+ \pi^+ \pi^-)/\Gamma(D_s^- \pi^+)$   $\Gamma_{12}/\Gamma_{10}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>2.05±0.34 OUR FIT</b>			
<b>2.01±0.37±0.20</b>	AAIJ	11E	LHCB $pp$ at 7 TeV

$\Gamma(D_{s1}(2536)^- \pi^+, D_{s1}^- \rightarrow D_s^- \pi^+ \pi^-)/\Gamma(D_s^- \pi^+ \pi^+ \pi^-)$   $\Gamma_{13}/\Gamma_{12}$

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

$\Gamma(D_s^\mp K^\pm)/\Gamma_{\text{total}}$   $\Gamma_{14}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.27±0.19 OUR FIT</b>			
<b>2.3 <math>^{+1.2}_{-1.0}</math> <math>^{+0.4}_{-0.3}</math></b>	<sup>1</sup> LOUVOT	09	BELL $e^+e^- \rightarrow \gamma(5S)$

<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  $B(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (20.1 \pm 3.1) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^\mp K^\pm)/\Gamma(D_s^- \pi^+)$   $\Gamma_{14}/\Gamma_{10}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>7.55±0.24 OUR FIT</b>			
<b>7.55±0.24 OUR AVERAGE</b>			
7.52±0.15±0.19	AAIJ	15AC	LHCB $pp$ at 7, 8 TeV
9.7 ±1.8 ±0.9	AALTONEN	09AQ	CDF $p\bar{p}$ at 1.96 TeV
• • •			We do not use the following data for averages, fits, limits, etc. • • •
6.46±0.43±0.25	AAIJ	12AG	LHCB Repl. by AAIJ 15AC

$\Gamma(D_s^- K^+ \pi^+ \pi^-)/\Gamma(D_s^- \pi^+ \pi^+ \pi^-)$   $\Gamma_{15}/\Gamma_{12}$

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

$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$   $\Gamma_{16}/\Gamma$

VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>4.4±0.5 OUR AVERAGE</b>				
4.0±0.2±0.5		<sup>1</sup> AAIJ	13AP	LHCB $pp$ at 7 TeV
5.8 $^{+1.1}_{-0.9}$ ±1.3		<sup>2</sup> ESEN	13	BELL $e^+e^- \rightarrow \gamma(5S)$
5.3±0.8±0.6		<sup>3</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>4</sup> ESEN	10	BELL Repl. by ESEN 13
10.4 $^{+3.5}_{-3.2}$ ±1.1		<sup>5</sup> AALTONEN	08F	CDF Repl. by AALTONEN 12C
<67	90	DRUTSKOY	07A	BELL Repl. by ESEN 10

<sup>1</sup> Uses  $B(B^0 \rightarrow D^- D_s^+) = (7.2 \pm 0.8) \times 10^{-3}$ .

<sup>2</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>3</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  $1/2 f_s/f_d = 0.125 \pm 0.006$ . Our first quoted uncertainty is the combined experiment's uncertainty and our second is the systematic uncertainty from using our best values.

<sup>4</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  $\Gamma(\gamma(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\gamma(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

<sup>5</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.

**$\Gamma(D_S^- D^+)/\Gamma_{\text{total}}$**   **$\Gamma_{17}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>2.8 \pm 0.4 \pm 0.3</math></b>	<sup>1</sup> AAIJ	14AA LHCB	$pp$ at 7 TeV

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

$3.6 \pm 0.6 \pm 0.5$	<sup>2</sup> AAIJ	13AP LHCB	Repl. by AAIJ 14AA
-----------------------	-------------------	-----------	--------------------

<sup>1</sup> AAIJ 14AA reports  $[\Gamma(B_S^0 \rightarrow D_S^- D^+)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^- D_S^+)] = 0.038 \pm 0.004 \pm 0.003$  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..

<sup>2</sup> Uses  $B(B^0 \rightarrow D^- D_S^+) = (7.2 \pm 0.8) \times 10^{-3}$ .

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

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>2.2 \pm 0.4 \pm 0.4</math></b>	<sup>1</sup> AAIJ	13AP LHCB	$pp$ at 7 TeV

<sup>1</sup> Uses  $B(B^0 \rightarrow D^- D^+) = (2.11 \pm 0.31) \times 10^{-4}$  and  $B(B^+ \rightarrow \bar{D}^0 D_S^+) = (10.1 \pm 1.7) \times 10^{-3}$ .

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

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>1.9 \pm 0.3 \pm 0.4</math></b>	<sup>1</sup> AAIJ	13AP LHCB	$pp$ at 7 TeV

<sup>1</sup> Uses  $B(B^0 \rightarrow D^- D^+) = (2.11 \pm 0.31) \times 10^{-4}$  and  $B(B^+ \rightarrow \bar{D}^0 D_S^+) = (10.1 \pm 1.7) \times 10^{-3}$ .

**$\Gamma(D_S^{*-} \pi^+)/\Gamma_{\text{total}}$**   **$\Gamma_{20}/\Gamma$**

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

<sup>1</sup> LOUVOT 10 reports  $[\Gamma(B_S^0 \rightarrow D_S^{*-} \pi^+)/\Gamma_{\text{total}}] / [B(B_S^0 \rightarrow D_S^- \pi^+)] = 0.65^{+0.15}_{-0.13} \pm 0.07$  which we multiply by our best value  $B(B_S^0 \rightarrow D_S^- \pi^+) = (3.00 \pm 0.23) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(D_S^{*\mp} K^\pm)/\Gamma(D_S^{*-} \pi^+)$**   **$\Gamma_{21}/\Gamma_{20}$**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.068 \pm 0.005^{+0.003}_{-0.002}</math></b>	AAIJ	15AD LHCB	$pp$ at 7, 8 TeV

$\Gamma(D_s^{*-} \rho^+)/\Gamma_{\text{total}}$				$\Gamma_{22}/\Gamma$
VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT	
<b><math>9.6 \pm 2.0^{+0.7}_{-0.8}</math></b>	<sup>1</sup> LOUVOT	10	BELL	$e^+ e^- \rightarrow \Upsilon(5S)$

<sup>1</sup> LOUVOT 10 reports  $[\Gamma(B_s^0 \rightarrow D_s^{*-} \rho^+)/\Gamma_{\text{total}}] / [B(B_s^0 \rightarrow D_s^- \pi^+)] = 3.2 \pm 0.6 \pm 0.3$  which we multiply by our best value  $B(B_s^0 \rightarrow D_s^- \pi^+) = (3.00 \pm 0.23) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^{*-} \rho^+)/\Gamma(D_s^- \rho^+)$				$\Gamma_{22}/\Gamma_{11}$
VALUE	DOCUMENT ID	TECN	COMMENT	
$1.4 \pm 0.3 \pm 0.1$	LOUVOT	10	BELL	$e^+ e^- \rightarrow \Upsilon(5S)$

$[\Gamma(D_s^{*+} D_s^-) + \Gamma(D_s^{*-} D_s^+)]/\Gamma_{\text{total}}$				$\Gamma_{23}/\Gamma$
VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>13.8 \pm 1.6</math> OUR AVERAGE</b>				
$13.6 \pm 1.0 \pm 1.4$		<sup>1</sup> AAIJ	16P	LHCB $pp$ at 7 TeV
$17.6^{+2.3}_{-2.2} \pm 4.0$		<sup>2</sup> ESEN	13	BELL $e^+ e^- \rightarrow \Upsilon(5S)$
$12.3 \pm 1.7 \pm 1.4$		<sup>3</sup> AALTONEN	12C	CDF $p\bar{p}$ at 1.96 TeV
$27.5^{+8.3}_{-7.1} \pm 6.9$		<sup>4</sup> ESEN	10	BELL Repl. by ESEN 13
<121	90	DRUTSKOY	07A	BELL Repl. by ESEN 10

<sup>1</sup> AAIJ 16P reports  $[\Gamma(B_s^0 \rightarrow D_s^{*+} D_s^-) + \Gamma(D_s^{*-} D_s^+)]/\Gamma_{\text{total}} / [B(B^0 \rightarrow D^- D_s^+)] = 1.88 \pm 0.08 \pm 0.12$  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.

<sup>2</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>3</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  $1/2 f_s/f_d = 0.125 \pm 0.006$ . Our first quoted uncertainty is the combined experiment's uncertainty and our second is the systematic uncertainty from using our best values.

<sup>4</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  $\Gamma(\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

$\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$				$\Gamma_{24}/\Gamma$
VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>14.4 \pm 2.0</math> OUR AVERAGE</b>		Error includes scale factor of 1.1.		
$12.7 \pm 1.3 \pm 1.4$		<sup>1</sup> AAIJ	16P	LHCB $pp$ at 7 TeV
$19.8^{+3.3}_{-3.1} \pm 5.2$		<sup>2</sup> ESEN	13	BELL $e^+ e^- \rightarrow \Upsilon(5S)$
$18.9 \pm 2.8 \pm 2.2$		<sup>3</sup> AALTONEN	12C	CDF $p\bar{p}$ at 1.96 TeV

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



Our first quoted uncertainty is the combined experiment's uncertainty and our second is the systematic uncertainty from using our best values.

<sup>4</sup> Uses the final states where  $D_s^+ \rightarrow \phi\pi^+$  and  $D_s^- \rightarrow \phi\mu^-\bar{\nu}_\mu$ .

<sup>5</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>6</sup> Uses  $\phi\phi$  correlations from  $B_s^0(\text{short}) \rightarrow D_s^{(*)+} D_s^{(*)-}$ .

<sup>7</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>8</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  $\Gamma(\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

### $\Gamma(\bar{D}^{*0} \bar{K}^0) / \Gamma_{\text{total}}$ $\Gamma_{26} / \Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.8 ± 1.0 ± 0.5</b>	<sup>1</sup> AAIJ	16C	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Measured and normalized to the  $B_s^0 \rightarrow \bar{D}^{*0} K_S^0$  decay with  $f_s/f_d = 0.259 \pm 0.015$ . Signal significance is 4.4 standard deviations.

### $\Gamma(\bar{D}^0 \bar{K}^0) / \Gamma_{\text{total}}$ $\Gamma_{27} / \Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>4.3 ± 0.5 ± 0.7</b>	<sup>1</sup> AAIJ	16C	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Measured and normalized to the  $B^0 \rightarrow \bar{D}^0 K_S^0$  decay with  $f_s/f_d = 0.259 \pm 0.015$ .

### $\Gamma(\bar{D}^0 K^- \pi^+) / \Gamma_{\text{total}}$ $\Gamma_{28} / \Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>10.4 ± 1.1 ± 0.5</b>	<sup>1</sup> AAIJ	13AQ	LHCB $pp$ at 7 TeV

<sup>1</sup> AAIJ 13AQ reports  $[\Gamma(B_s^0 \rightarrow \bar{D}^0 K^- \pi^+) / \Gamma_{\text{total}}] / [B(B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-)] = 1.18 \pm 0.05 \pm 0.12$  which we multiply by our best value  $B(B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-) = (8.8 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

### $\Gamma(\bar{D}^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}$ $\Gamma_{29} / \Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>4.4 ± 0.6 OUR AVERAGE</b>			

4.29 ± 0.09 ± 0.65 <sup>1</sup> AAIJ 14BH LHCB  $pp$  at 7, 8 TeV

4.7 ± 1.2 ± 0.3 <sup>2</sup> AAIJ 11D LHCB  $pp$  at 7 TeV

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

3.5 ± 0.4 ± 0.4 <sup>3</sup> AAIJ 13BX LHCB Repl. by AAIJ 14BH

<sup>1</sup> Uses Dalitz plot analysis of  $B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$  decays.

<sup>2</sup> AAIJ 11D reports  $[\Gamma(B_s^0 \rightarrow \bar{D}^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}] / [B(B^0 \rightarrow \bar{D}^0 \rho^0)] = 1.48 \pm 0.34 \pm 0.19$  which we multiply by our best value  $B(B^0 \rightarrow \bar{D}^0 \rho^0) = (3.21 \pm 0.21) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>3</sup> AAIJ 13BX reports  $[\Gamma(B_s^0 \rightarrow \bar{D}^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}] / [B(B^0 \rightarrow \bar{D}^0 K^*(892)^0)] = 7.8 \pm 0.7 \pm 0.3 \pm 0.6$  which we multiply by our best value  $B(B^0 \rightarrow \bar{D}^0 K^*(892)^0) = (4.5 \pm 0.6) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\overline{D}^0 \overline{K}^*(1410))/\Gamma_{\text{total}}$   $\Gamma_{30}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>38.6 \pm 11.4 \pm 33.3</math></b>		<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

 $\Gamma(\overline{D}^0 \overline{K}_0^*(1430))/\Gamma_{\text{total}}$   $\Gamma_{31}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>30.0 \pm 2.4 \pm 6.8</math></b>		<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays. Corresponds to the resonant  $K_0^*(1430)$  part of LASS parametrization.

 $\Gamma(\overline{D}^0 \overline{K}_2^*(1430))/\Gamma_{\text{total}}$   $\Gamma_{32}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>11.1 \pm 1.8 \pm 3.8</math></b>		<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

 $\Gamma(\overline{D}^0 \overline{K}^*(1680))/\Gamma_{\text{total}}$   $\Gamma_{33}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 7.8</math></b>	90	<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

 $\Gamma(\overline{D}^0 \overline{K}_0^*(1950))/\Gamma_{\text{total}}$   $\Gamma_{34}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 11</math></b>	90	<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

 $\Gamma(\overline{D}^0 \overline{K}_3^*(1780))/\Gamma_{\text{total}}$   $\Gamma_{35}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 2.6</math></b>	90	<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

 $\Gamma(\overline{D}^0 \overline{K}_4^*(2045))/\Gamma_{\text{total}}$   $\Gamma_{36}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 3.1</math></b>	90	<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

 $\Gamma(\overline{D}^0 K^- \pi^+ (\text{non-resonant}))/\Gamma_{\text{total}}$   $\Gamma_{37}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>20.6 \pm 3.8 \pm 7.3</math></b>		<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays. Corresponds to the non-resonant part of the LASS parametrization.



$$\Gamma(D_{s2}^*(2573)^- \pi^+, D_{s2}^* \rightarrow \bar{D}^0 K^-) / \Gamma_{\text{total}} \quad \Gamma_{38}/\Gamma$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>25.7 \pm 0.7 \pm 4.0</math></b>	<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$  decays.

$$\Gamma(D_{s1}^*(2700)^- \pi^+, D_{s1}^* \rightarrow \bar{D}^0 K^-) / \Gamma_{\text{total}} \quad \Gamma_{39}/\Gamma$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>1.6 \pm 0.4 \pm 0.7</math></b>	<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$  decays.

$$\Gamma(D_{s1}^*(2860)^- \pi^+, D_{s1}^* \rightarrow \bar{D}^0 K^-) / \Gamma_{\text{total}} \quad \Gamma_{40}/\Gamma$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>5.0 \pm 1.2 \pm 3.4</math></b>	<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$  decays.

$$\Gamma(D_{s3}^*(2860)^- \pi^+, D_{s3}^* \rightarrow \bar{D}^0 K^-) / \Gamma_{\text{total}} \quad \Gamma_{41}/\Gamma$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>2.2 \pm 0.1 \pm 0.6</math></b>	<sup>1</sup> AAIJ	14BH LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses Dalitz plot analysis of  $B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$  decays.

$$\Gamma(\bar{D}^0 K^+ K^-) / \Gamma_{\text{total}} \quad \Gamma_{42}/\Gamma$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>4.4 \pm 1.7 \pm 1.1</math></b>	<sup>1,2</sup> AAIJ	12AMLHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 12AM reports  $[\Gamma(B_s^0 \rightarrow \bar{D}^0 K^+ K^-) / \Gamma_{\text{total}}] / [B(B^0 \rightarrow \bar{D}^0 K^+ K^-)] = 0.90 \pm 0.27 \pm 0.20$  which we multiply by our best value  $B(B^0 \rightarrow \bar{D}^0 K^+ K^-) = (4.9 \pm 1.2) \times 10^{-5}$ . 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.

$$\Gamma(\bar{D}^0 f_0(980)) / \Gamma_{\text{total}} \quad \Gamma_{43}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 3.1 \times 10^{-6}</math></b>	90	AAIJ	15AG LHCB	$pp$ at 7, 8 TeV

$$\Gamma(\bar{D}^0 \phi) / \Gamma(\bar{D}^0 \bar{K}^*(892)^0) \quad \Gamma_{44}/\Gamma_{29}$$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.069 \pm 0.013 \pm 0.007</math></b>	AAIJ	13BX LHCB	$pp$ at 7 TeV

$$\Gamma(D^{*\mp} \pi^\pm) / \Gamma_{\text{total}} \quad \Gamma_{45}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 6.1 \times 10^{-6}</math></b>	90	<sup>1</sup> AAIJ	13AL LHCB	$pp$ at 7 TeV

<sup>1</sup> Uses  $f_s/f_d = 0.256 \pm 0.020$  and  $B(B^0 \rightarrow D^{*-} \pi^+) = (2.76 \pm 0.13) \times 10^{-3}$ .

$\Gamma(\eta_c \phi)/\Gamma_{\text{total}}$   $\Gamma_{46}/\Gamma$ 

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>5.01 ± 0.53 ± 0.68</b>	<sup>1</sup> AAIJ	17U LHCB	$pp$ at 7, 8 TeV

<sup>1</sup>The last uncertainty includes the limited knowledge of the external branching fractions where the  $\eta_c$  is reconstructed in the  $p\bar{p}, K^+ K^- \pi^+ \pi^-, \pi^+ \pi^- \pi^+ \pi^-$ , and  $K^+ K^- K^+ K^-$  decays and  $\phi(1020) \rightarrow K^+ K^-$ .

 $\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{47}/\Gamma$ 

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.76 ± 0.59 ± 0.31</b>	<sup>1</sup> AAIJ	17U LHCB	$pp$ at 7, 8 TeV

<sup>1</sup>The last uncertainty includes the limited knowledge of the external branching fractions where the  $\eta_c$  is reconstructed in the  $p\bar{p}, K^+ K^- \pi^+ \pi^-, \pi^+ \pi^- \pi^+ \pi^-$ , and  $K^+ K^- K^+ K^-$  decays. The significance of the signal, including systematic uncertainties, is 4.6 standard deviations.

 $\Gamma(J/\psi(1S)\phi)/\Gamma_{\text{total}}$   $\Gamma_{48}/\Gamma$ 

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.08 ± 0.08 OUR FIT</b>				
<b>1.10 ± 0.09 OUR AVERAGE</b>				
1.050 ± 0.013 ± 0.104		<sup>1</sup> AAIJ	13AN LHCB	$pp$ at 7 TeV
1.25 ± 0.07 ± 0.23		<sup>2</sup> THORNE	13 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$
1.5 ± 0.5 ± 0.1		<sup>3</sup> ABE	96Q CDF	$p\bar{p}$

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

<6	1	<sup>4</sup> AKERS	94J OPAL	$e^+ e^- \rightarrow Z$
seen	14	<sup>5</sup> ABE	93F CDF	$p\bar{p}$ at 1.8 TeV
seen	1	<sup>6</sup> ACTON	92N OPAL	Sup. by AKERS 94J

<sup>1</sup> Uses  $f_s/f_d = 0.256 \pm 0.020$  and  $B(B^+ \rightarrow J/\psi K^+) = (10.18 \pm 0.42) \times 10^{-4}$ .

<sup>2</sup> Uses  $f_s = (17.2 \pm 3.0)\%$  as the fraction of  $\Upsilon(5S)$  decaying to  $B_s^{(*)} \bar{B}_s^{(*)}$ .

<sup>3</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  $\Gamma(\bar{b} \rightarrow B_s^0)/[\Gamma(\bar{b} \rightarrow B^+) + \Gamma(\bar{b} \rightarrow B^0)] = 0.125 \pm 0.006$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>4</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>5</sup> ABE 93F measured using  $J/\psi(1S) \rightarrow \mu^+ \mu^-$  and  $\phi \rightarrow K^+ K^-$ .

<sup>6</sup> In ACTON 92N a limit on the product branching fraction is measured to be  $f(\bar{b} \rightarrow B_s^0) \cdot B(B_s^0 \rightarrow J/\psi(1S)\phi) \leq 0.22 \times 10^{-2}$ .

 $\Gamma(J/\psi(1S)\phi\phi)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{49}/\Gamma_{48}$ 

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.15 ± 0.12<sup>+0.05</sup><sub>-0.09</sub></b>	128	<sup>1</sup> AAIJ	16U LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses  $J/\psi \rightarrow \mu^+ \mu^-, \phi \rightarrow K^+ K^-$  decays, and observes  $128 \pm 13$  events of  $B_s^0 \rightarrow J/\psi\phi\phi$ .

$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{50}/\Gamma$

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

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

$\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$   $\Gamma_{51}/\Gamma$

VALUE (units $10^{-4}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>4.0 \pm 0.7</math> OUR AVERAGE</b>				Error includes scale factor of 1.4.
$3.6^{+0.5}_{-0.6}$		<sup>1</sup> AAIJ	13A	LHCB $pp$ at 7 TeV
$5.10 \pm 0.50^{+1.17}_{-0.83}$		<sup>2</sup> LI	12	BELL $e^+e^- \rightarrow \gamma(4S)$

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

$<38$	90	<sup>3</sup> ACCIARRI	97C L3
-------	----	-----------------------	--------

<sup>1</sup> AAIJ 13A reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)\eta)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)\rho^0)] = 14.0 \pm 1.2^{+1.1}_{-1.5} {}^{+1.1}_{-1.0}$  which we multiply by our best value  $B(B^0 \rightarrow J/\psi(1S)\rho^0) = (2.55^{+0.18}_{-0.16}) \times 10^{-5}$ . 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  $B_S$  ( $12.0 \pm 3.0\%$ ).

$\Gamma(J/\psi(1S)K_S^0)/\Gamma_{\text{total}}$   $\Gamma_{52}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>1.88 \pm 0.15</math> OUR AVERAGE</b>			
$1.88 \pm 0.14 \pm 0.07$	<sup>1</sup> AAIJ	15AL	LHCB $pp$ at 7, 8 TeV
$1.9 \pm 0.4 \pm 0.1$	<sup>2</sup> AALTONEN	11A	CDF $p\bar{p}$ at 1.96 TeV

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

$1.96 \pm 0.15 \pm 0.12$	<sup>3</sup> AAIJ	13AB	LHCB Repl. by AAIJ 15AL
$1.96 \pm 0.25 \pm 0.12$	<sup>4</sup> AAIJ	12O	LHCB Repl. by AAIJ 13AB

<sup>1</sup> AAIJ 15AL reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)K_S^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)K_S^0)] = (4.31 \pm 0.17 \pm 0.12 \pm 0.25) \times 10^{-2}$  which we multiply by our best value  $B(B^0 \rightarrow J/\psi(1S)K_S^0) = (4.36 \pm 0.16) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> AALTONEN 11A reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)K_S^0)/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow B_S^0)] / [B(\bar{b} \rightarrow B^0)] / [B(B^0 \rightarrow J/\psi(1S)K_S^0)] = (1.09 \pm 0.19 \pm 0.11) \times 10^{-2}$  which we multiply or divide by our best values  $B(\bar{b} \rightarrow B_S^0) = (10.1 \pm 0.4) \times 10^{-2}$ ,  $B(\bar{b} \rightarrow B^0) = (40.5 \pm 0.6) \times 10^{-2}$ ,  $B(B^0 \rightarrow J/\psi(1S)K_S^0) = 1/2 \times B(B^0 \rightarrow J/\psi(1S)K^0) = 1/2 \times (8.73 \pm 0.32) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>3</sup> AAIJ 13AB reports  $(1.97 \pm 0.14 \pm 0.07 \pm 0.15 \pm 0.08) \times 10^{-5}$  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  $B(B^0 \rightarrow J/\psi(1S)K^0) = (8.98 \pm 0.35) \times 10^{-4}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.256 \pm 0.020$ , which we rescale to our best values  $B(B^0 \rightarrow J/\psi(1S)K^0) = (8.73 \pm 0.32) \times 10^{-4}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.250 \pm 0.012$ . Our first error is

their experiment's error and our second error is the systematic error from using our best values.

<sup>4</sup> AAIJ 12O 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  $B(B^0 \rightarrow J/\psi(1S)K^0) = (8.71 \pm 0.32) \times 10^{-4}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.267^{+0.021}_{-0.02}$ , which we rescale to our best values  $B(B^0 \rightarrow J/\psi(1S)K^0) = (8.73 \pm 0.32) \times 10^{-4}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.250 \pm 0.012$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

### $\Gamma(J/\psi(1S)\bar{K}^*(892)^0)/\Gamma_{\text{total}}$ $\Gamma_{53}/\Gamma$

<u>VALUE (units <math>10^{-5}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>4.14 ± 0.18 ± 0.35</b>	<sup>1</sup> AAIJ	15AV LHCB	$p\bar{p}$ at 7, 8 TeV
4.4 $^{+0.5}_{-0.4} \pm 0.8$	<sup>2</sup> AAIJ	12AP LHCB	Repl. by AAIJ 15AV
8.5 ± 3.7 ± 0.5	<sup>3</sup> AALTONEN	11A CDF	$p\bar{p}$ at 1.96 TeV

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

<sup>1</sup> AAIJ 15AV result combines two measurements with different normalizing modes of  $B^0 \rightarrow J/\psi K^*(892)^0$  and  $B_S^0 \rightarrow J/\psi\phi$ .

<sup>2</sup> AAIJ 12AP reports  $B(B_S^0 \rightarrow J/\psi(1S)\bar{K}^*(892)^0)/B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (3.43^{+0.34}_{-0.36} \pm 0.50) \times 10^{-2}$  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>3</sup> AALTONEN 11A reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)\bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow B_S^0)] / [B(\bar{b} \rightarrow B^0)] / [B(B^0 \rightarrow J/\psi(1S)K^*(892)^0)] = 0.0168 \pm 0.0024 \pm 0.0068$  which we multiply or divide by our best values  $B(\bar{b} \rightarrow B_S^0) = (10.1 \pm 0.4) \times 10^{-2}$ ,  $B(\bar{b} \rightarrow B^0) = (40.5 \pm 0.6) \times 10^{-2}$ ,  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.27 \pm 0.05) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

### $\Gamma(J/\psi(1S)\eta')/\Gamma_{\text{total}}$ $\Gamma_{54}/\Gamma$

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3.3 ± 0.4 OUR AVERAGE</b>			
3.2 $^{+0.4}_{-0.5} \pm 0.2$	<sup>1</sup> AAIJ	13A LHCB	$p\bar{p}$ at 7 TeV
3.71 ± 0.61 $^{+0.85}_{-0.60}$	<sup>2</sup> LI	12 BELL	$e^+e^- \rightarrow \gamma(4S)$

<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  $B(B^0 \rightarrow J/\psi(1S)\rho^0) = (2.55^{+0.18}_{-0.16}) \times 10^{-5}$ . 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  $N(B_S^{(*)}\bar{B}_S^{(*)})$ .

$$\Gamma(J/\psi(1S)\eta')/\Gamma(J/\psi(1S)\eta) \quad \Gamma_{54}/\Gamma_{51}$$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.87 ± 0.06 OUR AVERAGE</b>			
0.902 ± 0.072 ± 0.045	<sup>1</sup> AAIJ	15D	LHCB $pp$ at 7, 8 TeV
0.90 ± 0.09 $\begin{smallmatrix} +0.06 \\ -0.02 \end{smallmatrix}$	<sup>2</sup> AAIJ	13A	LHCB $pp$ at 7 TeV
0.73 ± 0.14 ± 0.02	<sup>2</sup> LI	12	BELL $e^+e^- \rightarrow \gamma(4S)$

<sup>1</sup> Uses  $J/\psi \rightarrow \mu^+\mu^-$ ,  $\eta' \rightarrow \rho^0\gamma$ , and  $\eta' \rightarrow \eta\pi^+\pi^-$  decays.

<sup>2</sup> Strongly correlated with measurements of  $\Gamma(J/\psi(1S)\eta)/\Gamma$  and  $\Gamma(J/\psi(1S)\eta')/\Gamma$  reported in the same reference.

$$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\phi) \quad \Gamma_{55}/\Gamma_{48}$$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>19.4 ± 1.5 OUR FIT</b> Error includes scale factor of 2.2.			
<b>19.9 ± 0.7 ± 0.2</b>	<sup>1</sup> AAIJ	12A0	LHCB $pp$ at 7 TeV

<sup>1</sup> AAIJ 12A0 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  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ , which we rescale to our best value  $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$$\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{58}/\Gamma$$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.28 ± 0.18 OUR FIT</b> Error includes scale factor of 1.7.			
<b>1.16 <math>\begin{smallmatrix} +0.31 + 0.30 \\ -0.19 - 0.25 \end{smallmatrix}</math></b>	<sup>1</sup> LI	11	BELL $e^+e^- \rightarrow \gamma(5S)$

<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.

$$\Gamma(J/\psi(1S)f_0(500), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-) \quad \Gamma_{56}/\Gamma_{58}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;0.034</b>	90	<sup>1</sup> AAIJ	14BR	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S)\rho, \rho \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-) \quad \Gamma_{57}/\Gamma_{55}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;0.017</b>	90	<sup>1</sup> AAIJ	14BR	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-) \quad \Gamma_{58}/\Gamma_{55}$$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.61 <math>\begin{smallmatrix} +0.06 \\ -0.07 \end{smallmatrix}</math> OUR FIT</b> Error includes scale factor of 2.1.			
<b>0.703 ± 0.015 <math>\begin{smallmatrix} +0.004 \\ -0.051 \end{smallmatrix}</math></b>	<sup>1</sup> AAIJ	14BR	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S) f_2(1270)_0, f_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-) \quad \Gamma_{60} / \Gamma_{55}$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
-----------	-------------	------	---------

$0.36 \pm 0.07 \pm 0.03$	<sup>1</sup> AAIJ	14BR LHCB	$pp$ at 7, 8 TeV
--------------------------	-------------------	-----------	------------------

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S) f_2(1270)_{\parallel}, f_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-) \quad \Gamma_{61} / \Gamma_{55}$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
-----------	-------------	------	---------

$0.52 \pm 0.15^{+0.05}_{-0.02}$	<sup>1</sup> AAIJ	14BR LHCB	$pp$ at 7, 8 TeV
---------------------------------	-------------------	-----------	------------------

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S) f_2(1270)_{\perp}, f_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-) \quad \Gamma_{62} / \Gamma_{55}$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
-----------	-------------	------	---------

$0.63 \pm 0.34^{+0.16}_{-0.08}$	<sup>1</sup> AAIJ	14BR LHCB	$pp$ at 7, 8 TeV
---------------------------------	-------------------	-----------	------------------

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S) f_0(1500), f_0 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-) \quad \Gamma_{64} / \Gamma_{55}$$

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

$0.101 \pm 0.008^{+0.011}_{-0.003}$	<sup>1</sup> AAIJ	14BR LHCB	$pp$ at 7, 8 TeV
-------------------------------------	-------------------	-----------	------------------

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S) f'_2(1525)_0, f'_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-) \quad \Gamma_{65} / \Gamma_{55}$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
-----------	-------------	------	---------

$0.51 \pm 0.09^{+0.05}_{-0.04}$	<sup>1</sup> AAIJ	14BR LHCB	$pp$ at 7, 8 TeV
---------------------------------	-------------------	-----------	------------------

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S) f'_2(1525)_{\parallel}, f'_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-) \quad \Gamma_{66} / \Gamma_{55}$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
-----------	-------------	------	---------

$0.06^{+0.13}_{-0.04} \pm 0.01$	<sup>1</sup> AAIJ	14BR LHCB	$pp$ at 7, 8 TeV
---------------------------------	-------------------	-----------	------------------

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S) f'_2(1525)_{\perp}, f'_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-) \quad \Gamma_{67} / \Gamma_{55}$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
-----------	-------------	------	---------

$0.26 \pm 0.18^{+0.06}_{-0.04}$	<sup>1</sup> AAIJ	14BR LHCB	$pp$ at 7, 8 TeV
---------------------------------	-------------------	-----------	------------------

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$$\Gamma(J/\psi(1S) f_0(1790), f_0 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-) \quad \Gamma_{68} / \Gamma_{55}$$

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

$0.024 \pm 0.004^{+0.050}_{-0.002}$	<sup>1</sup> AAIJ	14BR LHCB	$pp$ at 7, 8 TeV
-------------------------------------	-------------------	-----------	------------------

<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

$\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{58}/\Gamma_{48}$

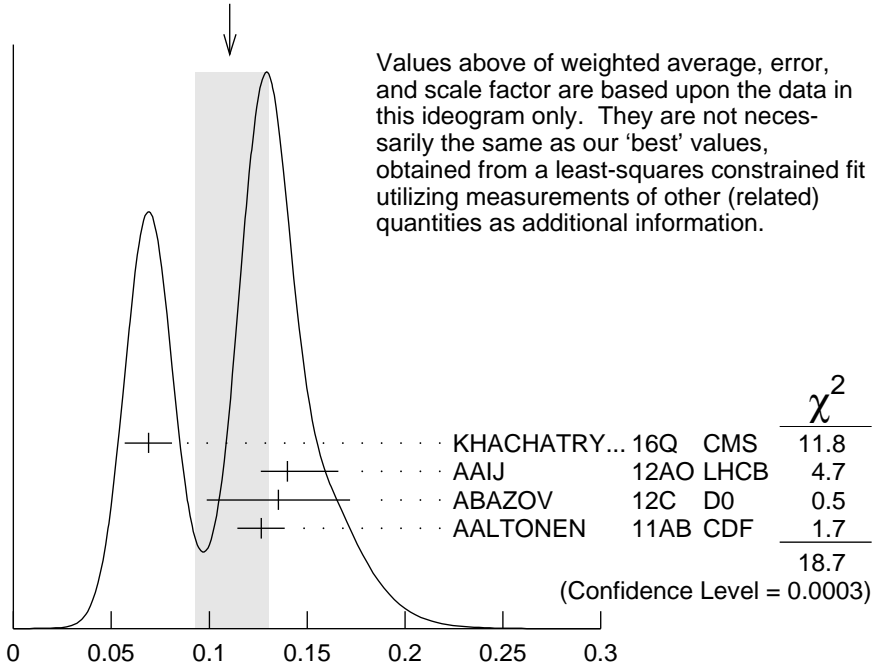
VALUE DOCUMENT ID TECN COMMENT

**0.119<sup>+0.013</sup><sub>-0.014</sub> OUR FIT** Error includes scale factor of 2.4.

**0.111<sup>+0.020</sup><sub>-0.018</sub> OUR AVERAGE** Error includes scale factor of 2.5. See the ideogram below.

0.069 ± 0.012 ± 0.001	<sup>1</sup> KHACHATRY...16Q	CMS	$p\bar{p}$ at 7 TeV
0.140 <sup>+0.026</sup> <sub>-0.013</sub> ± 0.002	<sup>2,3</sup> AAIJ	12AO LHCb	$p\bar{p}$ at 7 TeV
0.135 ± 0.036 ± 0.001	<sup>4</sup> ABAZOV	12C D0	$p\bar{p}$ at 1.96 TeV
0.126 ± 0.012 ± 0.001	<sup>5</sup> AALTONEN	11AB CDF	$p\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.124 <sup>+0.026</sup> <sub>-0.023</sub> ± 0.001	<sup>6</sup> AAIJ	11 LHCb	Repl. by AAIJ 12AO

WEIGHTED AVERAGE  
0.111+0.020-0.018 (Error scaled by 2.5)



Values above of weighted average, error, and scale factor are based upon the data in this ideogram only. They are not necessarily the same as our 'best' values, obtained from a least-squares constrained fit utilizing measurements of other (related) quantities as additional information.

$\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\phi)$

- <sup>1</sup> KHACHATRYAN 16Q reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)] / [B(\phi(1020) \rightarrow K^+K^-)] = 0.140 \pm 0.008 \pm 0.023$  which we multiply by our best value  $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.
- <sup>2</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  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ , which we rescale to our best value  $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.
- <sup>3</sup> Measured in Dalitz plot like analysis of  $B_S \rightarrow J/\psi\pi^+\pi^-$  decays.

<sup>4</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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . 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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>6</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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

### $\Gamma(J/\psi(1S) f_0(1370), f_0 \rightarrow \pi^+ \pi^-) / \Gamma_{\text{total}}$ $\Gamma_{63} / \Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
--------------------------	-------------	------	---------

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

$0.34^{+0.11+0.085}_{-0.14-0.054}$	<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.

### $\Gamma(J/\psi(1S) f_0(1370), f_0 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \phi)$ $\Gamma_{63} / \Gamma_{48}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
--------------------------	-------------	------	---------

$4.22^{+0.55}_{-3.76} \pm 0.05$	<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  $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5) \times 10^{-2}$ , which we rescale to our best value  $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

### $\Gamma(J/\psi(1S) f_2(1270), f_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \phi)$ $\Gamma_{59} / \Gamma_{48}$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
--------------------------	-------------	------	---------

$9.9^{+3.4}_{-3.6} \pm 0.1$	<sup>1,2</sup> 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  $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5) \times 10^{-2}$ , which we rescale to our best value  $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

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



$\Gamma(J/\psi(1S)\pi^+\pi^-(\text{nonresonant}))/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{69}/\Gamma_{48}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
$1.67^{+1.02}_{-0.32} \pm 0.02$	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  $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$ , which we rescale to our best value  $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

$\Gamma(J/\psi(1S)\bar{K}^0\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{70}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.4 \times 10^{-5}$	90	1 AAIJ	14L	LHCB $pp$ at 7 TeV

<sup>1</sup> Measured with  $B(B_S^0 \rightarrow J/\psi K_S^0\pi^+\pi^-) / B(B^0 \rightarrow J/\psi K_S^0\pi^+\pi^-)$  using PDG 12 values for the involved branching fractions.

$\Gamma(J/\psi(1S)K^+K^-)/\Gamma_{\text{total}}$   $\Gamma_{71}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>7.9 <math>\pm</math> 0.7 OUR AVERAGE</b>			

$7.70 \pm 0.08 \pm 0.72$	1 AAIJ	13AN	LHCB $pp$ at 7 TeV
$10.1 \pm 0.9 \pm 2.1$	2 THORNE	13	BELL $e^+e^- \rightarrow \Upsilon(5S)$

<sup>1</sup> Uses  $f_s/f_d = 0.256 \pm 0.020$  and  $B(B^+ \rightarrow J/\psi K^+) = (10.18 \pm 0.42) \times 10^{-4}$ .

<sup>2</sup> Uses  $f_s = (17.2 \pm 3.0)\%$  as the fraction of  $\Upsilon(5S)$  decaying to  $B_S^{(*)}\bar{B}_S^{(*)}$ .

$\Gamma(J/\psi(1S)K^0K^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{72}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>9.3 <math>\pm</math> 1.0 <math>\pm</math> 0.9</b>	1 AAIJ	14L	LHCB $pp$ at 7 TeV

<sup>1</sup> AAIJ 14L reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)K^0K^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)K^0\pi^+\pi^-)] = 2.12 \pm 0.15 \pm 0.18$  which we multiply by our best value  $B(B^0 \rightarrow J/\psi(1S)K^0\pi^+\pi^-) = (4.4 \pm 0.4) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value. This is an observation of  $B_S^0 \rightarrow J/\psi K_S^0 K^\pm \pi^\mp$  with more than 10 standard deviations.

$\Gamma(J/\psi(1S)\bar{K}^0K^+K^-)/\Gamma_{\text{total}}$   $\Gamma_{73}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<12 \times 10^{-6}$	90	1 AAIJ	14L	LHCB $pp$ at 7 TeV

<sup>1</sup> Measured with  $B(B_S^0 \rightarrow J/\psi K_S^0 K^+K^-) / B(B^0 \rightarrow J/\psi K_S^0 \pi^+\pi^-)$  using PDG 12 values for the involved branching fractions.

$\Gamma(J/\psi(1S)f_2'(1525))/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{74}/\Gamma_{48}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>21 <math>\pm</math> 4 OUR AVERAGE</b>			

$21.5 \pm 4.9 \pm 2.6$	1 THORNE	13	BELL $e^+e^- \rightarrow \Upsilon(5S)$
$21 \pm 7 \pm 1$	2,3 ABAZOV	12AF	D0 $p\bar{p}$ at 1.96 TeV

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

$27 \pm 4 \pm 1$	4 AAIJ	12S	LHCB Repl. by AAIJ 13AN
------------------	--------	-----	-------------------------

<sup>1</sup> Uses  $B(f'_2(1525) \rightarrow K^+ K^-) = (44.4 \pm 1.1)\%$ .

<sup>2</sup> ABAZOV 12AF reports  $[\Gamma(B_S^0 \rightarrow J/\psi(1S)f'_2(1525))/\Gamma(B_S^0 \rightarrow J/\psi(1S)\phi)] \times B(f'_2(1525) \rightarrow K^+ K^-) / B(\phi(1020) \rightarrow K^+ K^-) = 0.19 \pm 0.05 \pm 0.04$  which we divide and multiply by our best values  $B(f'_2(1525) \rightarrow K^+ K^-) = \frac{1}{2} (88.7 \pm 2.2) \times 10^{-2}$ ,  $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>3</sup> ABAZOV 12AF fits the invariant masses of the  $K^+ K^-$  pair in the range  $1.35 < M(K^+ K^-) < 2$  GeV.

<sup>4</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  $B(f'_2(1525) \rightarrow K^+ K^-) = \frac{1}{2} (88.7 \pm 2.2) \times 10^{-2}$ ,  $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

### $\Gamma(J/\psi(1S)f'_2(1525))/\Gamma_{\text{total}}$ $\Gamma_{74}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
$2.61 \pm 0.20^{+0.56}_{-0.50}$	<sup>1</sup> AAIJ	13AN	LHCB $pp$ at 7 TeV

<sup>1</sup> Uses  $f_s/f_d = 0.256 \pm 0.020$  and  $B(B^+ \rightarrow J/\psi K^+) = (10.18 \pm 0.42) \times 10^{-4}$ .

### $\Gamma(\psi(2S)\eta)/\Gamma(J/\psi(1S)\eta)$ $\Gamma_{79}/\Gamma_{51}$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.83 \pm 0.14 \pm 0.12$	<sup>1</sup> AAIJ	13AA	LHCB $pp$ at 7 TeV

<sup>1</sup> Assuming lepton universality for dimuon decay modes of  $J/\psi$  and  $\psi(2S)$  mesons, the ratio  $B(J/\psi \rightarrow \mu^+ \mu^-)/B(\psi(2S) \rightarrow \mu^+ \mu^-) = B(J/\psi \rightarrow e^+ e^-)/B(\psi(2S) \rightarrow e^+ e^-) = 7.69 \pm 0.19$  was used.

### $\Gamma(\psi(2S)\eta')/\Gamma(J/\psi(1S)\eta')$ $\Gamma_{80}/\Gamma_{54}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
$38.7 \pm 9.0 \pm 1.6$	<sup>1</sup> AAIJ	15D	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Uses  $J/\psi \rightarrow \mu^+ \mu^-$ ,  $\eta' \rightarrow \rho^0 \gamma$ , and  $\eta' \rightarrow \eta \pi^+ \pi^-$  decays.

### $\Gamma(J/\psi(1S)\rho\bar{\rho})/\Gamma_{\text{total}}$ $\Gamma_{75}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 4.8 \times 10^{-6}$	90	<sup>1</sup> AAIJ	13Z	LHCB $pp$ at 7 TeV

<sup>1</sup> Uses  $B(B_S^0 \rightarrow J/\psi(1S)\pi^+ \pi^-) = (1.98 \pm 0.20) \times 10^{-4}$ .

### $\Gamma(J/\psi(1S)\gamma)/\Gamma_{\text{total}}$ $\Gamma_{76}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 7.3 \times 10^{-6}$	90	<sup>1</sup> AAIJ	15BB	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Branching fractions of normalization modes  $B_S^0 \rightarrow J/\psi \gamma X$  taken from PDG 14. Uses  $f_s/f_d = 0.259 \pm 0.015$ .

$$\Gamma(J/\psi(1S)\pi^+\pi^-\pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-) \quad \Gamma_{77}/\Gamma_{55}$$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.371±0.015±0.022</b>	<sup>1</sup> AAIJ	14Y LHCb	$pp$ at 7,8 TeV

<sup>1</sup> Excludes contributions from  $\psi(2S)$  and  $\chi_{c1}(3872)$  decaying to  $J/\psi(1S)\pi^+\pi^-$ .

$$\Gamma(J/\psi(1S)f_1(1285))/\Gamma_{\text{total}} \quad \Gamma_{78}/\Gamma$$

<u>VALUE (units <math>10^{-5}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>7.0±1.3±0.4</b>	<sup>1</sup> AAIJ	14Y LHCb	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 14Y reports  $(7.14 \pm 0.99^{+0.83}_{-0.91} \pm 0.41) \times 10^{-5}$  from a measurement of  $[\Gamma(B_s^0 \rightarrow J/\psi(1S)f_1(1285))/\Gamma_{\text{total}}] \times [B(f_1(1285) \rightarrow 2\pi^+2\pi^-)]$  assuming  $B(f_1(1285) \rightarrow 2\pi^+2\pi^-) = 0.11^{+0.007}_{-0.006}$ , which we rescale to our best value  $B(f_1(1285) \rightarrow 2\pi^+2\pi^-) = (11.2^{+0.7}_{-0.6}) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$$\Gamma(\psi(2S)\phi)/\Gamma_{\text{total}} \quad \Gamma_{82}/\Gamma$$

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
---	-------------	--------------------	-------------	----------------

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

seen	1	BUSKULIC	93G ALEP	$e^+e^- \rightarrow Z$
------	---	----------	----------	------------------------

$$\Gamma(\psi(2S)\phi)/\Gamma(J/\psi(1S)\phi) \quad \Gamma_{82}/\Gamma_{48}$$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------	--------------------	-------------	----------------

**0.503±0.034 OUR AVERAGE**

0.500±0.034±0.011	<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  $B(J/\psi(1S) \rightarrow e^+e^-) = (5.971 \pm 0.032) \times 10^{-2}$ ,  $B(\psi(2S) \rightarrow e^+e^-) = (7.93 \pm 0.17) \times 10^{-3}$ . 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  $B(J/\psi \rightarrow \mu^+\mu^-) / B(\psi(2S) \rightarrow \mu^+\mu^-) = B(J/\psi \rightarrow e^+e^-) / B(\psi(2S) \rightarrow e^+e^-) = 7.69 \pm 0.19$ .

$$\Gamma(\psi(2S)K^-\pi^+)/\Gamma_{\text{total}} \quad \Gamma_{83}/\Gamma$$

<u>VALUE (units <math>10^{-5}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
---	--------------------	-------------	----------------

<b>3.12±0.30±0.21</b>	<sup>1</sup> AAIJ	15U LHCb	$pp$ at 7, 8 TeV
-----------------------	-------------------	----------	------------------

<sup>1</sup> AAIJ 15U reports  $[\Gamma(B_s^0 \rightarrow \psi(2S)K^-\pi^+)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \psi(2S)K^+\pi^-)] = (5.38 \pm 0.36 \pm 0.22 \pm 0.31) \times 10^{-2}$  which we multiply by our best value  $B(B^0 \rightarrow \psi(2S)K^+\pi^-) = (5.8 \pm 0.4) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\psi(2S)\bar{K}^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{84}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>3.3 \pm 0.5^{+0.2}_{-0.3}</math></b>	<sup>1</sup> AAIJ	15U	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 15U reports  $[\Gamma(B_s^0 \rightarrow \psi(2S)\bar{K}^*(892)^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \psi(2S)K^*(892)^0)] = (5.58 \pm 0.57 \pm 0.40 \pm 0.32) \times 10^{-2}$  which we multiply by our best value  $B(B^0 \rightarrow \psi(2S)K^*(892)^0) = (5.9 \pm 0.4) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\chi_{c1}\phi)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{85}/\Gamma_{48}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>18.9 \pm 1.8 \pm 1.5</math></b>	<sup>1</sup> AAIJ	13AC	LHCB $pp$ at 7 TeV

<sup>1</sup> Uses  $B(\chi_{c1} \rightarrow J/\psi\gamma) = (34.4 \pm 1.5)\%$ .

$\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$   $\Gamma_{81}/\Gamma_{55}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.34 \pm 0.04 \pm 0.03</math></b>	<sup>1</sup> AAIJ	13AA	LHCB $pp$ at 7 TeV

<sup>1</sup> Assuming lepton universality for dimuon decay modes of  $J/\psi$  and  $\psi(2S)$  mesons, the ratio  $B(J/\psi \rightarrow \mu^+\mu^-)/B(\psi(2S) \rightarrow \mu^+\mu^-) = B(J/\psi \rightarrow e^+e^-)/B(\psi(2S) \rightarrow e^+e^-) = 7.69 \pm 0.19$  was used.

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{86}/\Gamma$

VALUE (units $10^{-7}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>7.0 \pm 0.8</math> OUR AVERAGE</b>				
$7.2 \pm 0.9 \pm 0.4$		<sup>1</sup> AAIJ	17G	LHCB $pp$ at 7 and 8 TeV
$6.3 \pm 1.8 \pm 0.3$		<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. • • •

$10.2^{+2.4}_{-2.0} \pm 0.6$		<sup>3</sup> AAIJ	12AR	LHCB Repl. by AAIJ 17G
< 120	90	<sup>4</sup> PENG	10	BELL $e^+e^- \rightarrow \Upsilon(5S)$
< 12	90	<sup>5</sup> AALTONEN	09C	CDF Repl. by AALTONEN 12L
< 17	90	<sup>6</sup> ABULENCIA,A	06D	CDF Repl. by AALTONEN 09C
<2320	90	<sup>7</sup> ABE	00C	SLD $e^+e^- \rightarrow Z$
<1700	90	<sup>8</sup> BUSKULIC	96V	ALEP $e^+e^- \rightarrow Z$

<sup>1</sup> AAIJ 17G reports  $[\Gamma(B_s^0 \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^+\pi^-)] \times [\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0)] = (9.15 \pm 0.71 \pm 0.83) \times 10^{-3}$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+\pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.250 \pm 0.012$ . 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  $B(B^0 \rightarrow K^+\pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.250 \pm 0.012$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>3</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  $B(B^0 \rightarrow \pi^+\pi^-) = (5.12 \pm 0.19) \times 10^{-6}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.250 \pm 0.012$ .

Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>4</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>5</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>6</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>7</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>8</sup> BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.

### $\Gamma(\pi^0 \pi^0) / \Gamma_{\text{total}}$ $\Gamma_{87} / \Gamma$

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  $f_{B_s} = 12.0 \pm 3.0\%$ .

### $\Gamma(\eta \pi^0) / \Gamma_{\text{total}}$ $\Gamma_{88} / \Gamma$

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  $f_{B_s} = 12.0 \pm 3.0\%$ .

### $\Gamma(\eta \eta) / \Gamma_{\text{total}}$ $\Gamma_{89} / \Gamma$

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  $f_{B_s} = 12.0 \pm 3.0\%$ .

### $\Gamma(\rho^0 \rho^0) / \Gamma_{\text{total}}$ $\Gamma_{90} / \Gamma$

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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

### $\Gamma(\eta' \eta') / \Gamma_{\text{total}}$ $\Gamma_{91} / \Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
$3.3 \pm 0.7 \pm 0.1$	<sup>1</sup> AAIJ 150	LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 150 reports  $[\Gamma(B_s^0 \rightarrow \eta' \eta') / \Gamma_{\text{total}}] / [B(B^+ \rightarrow \eta' K^+)] = 0.47 \pm 0.09 \pm 0.04$  which we multiply by our best value  $B(B^+ \rightarrow \eta' K^+) = (7.06 \pm 0.25) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta' \phi)/\Gamma_{\text{total}}$   $\Gamma_{92}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.82 \times 10^{-6}$	90	<sup>1</sup> AAIJ	17BA LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Corresponds to the 95% CL upper limit  $1.01 \times 10^{-6}$ . Uses the normalization mode  $B^+ \rightarrow \eta' K^+$  with branching fraction  $(70.6 \pm 2.5) \times 10^{-6}$  and the ratio of hadronisation fractions  $f_s/f_d = 0.259 \pm 0.015$ , which is assumed equal to  $f_s/f_u$ .

$\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{96}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
$3.48 \pm 0.23 \pm 0.39$	<sup>1</sup> AAIJ	17A LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Inclusive decays in mass range  $400 < m(\pi^+ \pi^-) < 1600 \text{ MeV}/c^2$ .

$\Gamma(\phi \rho^0)/\Gamma_{\text{total}}$   $\Gamma_{95}/\Gamma$

VALUE (units $10^{-7}$ )	CL%	DOCUMENT ID	TECN	COMMENT
$2.7 \pm 0.7 \pm 0.3$		<sup>1</sup> AAIJ	17A LHCB	$pp$ at 7, 8 TeV

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

$<6170$	90	<sup>2</sup> ABE	00C SLD	$e^+ e^- \rightarrow Z$
---------	----	------------------	---------	-------------------------

<sup>1</sup> Signal evidence is 4 standard deviations.

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

$\Gamma(\phi f_0(980), f_0(980) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{93}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
$1.12 \pm 0.16 \pm 0.14$	<sup>1</sup> AAIJ	17A LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Signal is observed with 8 standard deviations significance.

$\Gamma(\phi f_2(1270), f_2(1270) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{94}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
$0.61 \pm 0.13^{+0.13}_{-0.08}$	<sup>1</sup> AAIJ	17A LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Signal is observed with 5 standard deviations significance.

$\Gamma(\phi \phi)/\Gamma_{\text{total}}$   $\Gamma_{97}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
$18.7 \pm 1.5$ OUR FIT				
$18.5 \pm 1.4 \pm 1.0$		<sup>1</sup> AAIJ	15AS LHCB	$pp$ at 7, 8 TeV

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

$14^{+6}_{-5} \pm 6$		<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> AAIJ 15AS reports  $[\Gamma(B_s^0 \rightarrow \phi \phi)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^*(892)^0 \phi)] = 1.84 \pm 0.05 \pm 0.13$  which we multiply by our best value  $B(B^0 \rightarrow K^*(892)^0 \phi) = (1.00 \pm 0.05) \times 10^{-5}$ . 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  $B(B^0 \rightarrow J/\psi \phi) = (1.38 \pm 0.49) \times 10^{-3}$  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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

$\Gamma(\phi\phi)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{97}/\Gamma_{48}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.73±0.16 OUR FIT</b>			
<b>1.78±0.14±0.20</b>	AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV

$\Gamma(\phi\phi\phi)/\Gamma(\phi\phi)$   $\Gamma_{98}/\Gamma_{97}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.117±0.030±0.015</b>	AAIJ	17BB LHCB	$pp$ at 7, 8 TeV

$\Gamma(\pi^+ K^-)/\Gamma_{total}$   $\Gamma_{99}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>5.7±0.6 OUR AVERAGE</b>				

5.8±0.7±0.3		<sup>1</sup> AAIJ	12AR LHCB	$pp$ at 7 TeV
5.6±1.0±0.3		<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	$e^+e^- \rightarrow \Upsilon(5S)$
< 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  $[\Gamma(B_s^0 \rightarrow \pi^+ K^-)/\Gamma_{total}] / [B(B^0 \rightarrow K^+ \pi^-)] \times [\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0)] = 0.074 \pm 0.006 \pm 0.006$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.250 \pm 0.012$ . 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  $[\Gamma(B_s^0 \rightarrow \pi^+ K^-)/\Gamma_{total}] / [B(B^0 \rightarrow K^+ \pi^-)] \times [B(\bar{b} \rightarrow B_s^0) / [B(\bar{b} \rightarrow B^0)]] = 0.071 \pm 0.010 \pm 0.007$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $B(\bar{b} \rightarrow B_s^0) = (10.1 \pm 0.4) \times 10^{-2}$ ,  $B(\bar{b} \rightarrow B^0) = (40.5 \pm 0.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best 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> 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  $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$  and  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

<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%).

$\Gamma(K^+ K^-)/\Gamma_{total}$   $\Gamma_{100}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>25.9± 1.7 OUR AVERAGE</b>				
24.8± 1.6±1.3		<sup>1</sup> AAIJ	12AR LHCB	$pp$ at 7 TeV
27.2± 2.3±1.5		<sup>2</sup> AALTONEN	11N CDF	$p\bar{p}$ at 1.96 TeV
38 $^{+10}_{-9}$ ±7		<sup>3</sup> PENG	10 BELL	$e^+e^- \rightarrow \Upsilon(5S)$

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

<310	90	DRUTSKOY 07A BELL	$e^+e^- \rightarrow \Upsilon(5S)$
33 ± 6 ± 7		4 ABULENCIA,A 06D CDF	Repl. by AALTONEN 11N
<283	90	5 ABE 00C SLD	$e^+e^- \rightarrow Z$
< 59	90	6 BUSKULIC 96V ALEP	$e^+e^- \rightarrow Z$
<140	90	7 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  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.250 \pm 0.012$ . 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  $1/2 f_s/f_d = 0.125 \pm 0.006$ . 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  $\Gamma(\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

<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  $f_{B^0} = f_{B^+} = (39.7^{+1.8}_{-2.2})\%$  and  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

<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%).

$\Gamma(K^0 \bar{K}^0)/\Gamma_{\text{total}}$					$\Gamma_{101}/\Gamma$
VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT	
<b><math>1.96^{+0.58}_{-0.51} \pm 0.10 \pm 0.20</math></b>		<sup>1</sup> PAL	16	BELL	$e^+e^- \rightarrow \Upsilon(5S)$

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

<6.6	90	<sup>2</sup> PENG 10 BELL	Repl. by PAL 16
		<sup>1</sup> Observed in $B_s^0 \rightarrow K_S^0 K_S^0$	with significance of 5.1 $\sigma$ . The last uncertainty is due to the uncertainty of the total number of $B_s^0 \bar{B}_s^0$ pairs.
		<sup>2</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 $\Gamma(\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

$\Gamma(K^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$					$\Gamma_{102}/\Gamma$
VALUE (units $10^{-6}$ )		DOCUMENT ID	TECN	COMMENT	
<b><math>9.4 \pm 2.1 \pm 0.3</math></b>		<sup>1,2</sup> AAIJ	17BP	LHCB	$pp$ at 7, 8 TeV

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

14 ± 4 ± 1		<sup>3</sup> AAIJ	13BP	LHCB	Repl. by AAIJ 17BP
------------	--	-------------------	------	------	--------------------



<sup>1</sup> AAIJ 17BP reports  $[\Gamma(B_S^0 \rightarrow K^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^0 \pi^+ \pi^-)] = 0.191 \pm 0.027 \pm 0.033$  which we multiply by our best value  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.94 \pm 0.18) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> Used  $f_s/f_d = 0.259 \pm 0.015$ .

<sup>3</sup> AAIJ 13BP reports  $[\Gamma(B_S^0 \rightarrow K^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^0 \pi^+ \pi^-)] = 0.29 \pm 0.06 \pm 0.04$  which we multiply by our best value  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.94 \pm 0.18) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

### $\Gamma(K^*(892)^- \pi^+)/\Gamma_{\text{total}}$

$\Gamma_{104}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b>3.3±1.2±0.3</b>	1,2 AAIJ	14BMLHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 14BM reports  $[\Gamma(B_S^0 \rightarrow K^*(892)^- \pi^+)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^*(892)^+ \pi^-)] = 0.39 \pm 0.13 \pm 0.05$  which we multiply by our best value  $B(B^0 \rightarrow K^*(892)^+ \pi^-) = (8.4 \pm 0.8) \times 10^{-6}$ . 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  $f_s/f_d = 0.259 \pm 0.015$ .

### $\Gamma(K^0 K^\pm \pi^\mp)/\Gamma_{\text{total}}$

$\Gamma_{103}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>8.4±0.8±0.3</b>	1,2 AAIJ	17BP LHCB	$pp$ at 7, 8 TeV

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

7.3±0.9±0.3	<sup>3</sup> AAIJ	13BP LHCB	Repl. by AAIJ 17BP
-------------	-------------------	-----------	--------------------

<sup>1</sup> AAIJ 17BP reports  $[\Gamma(B_S^0 \rightarrow K^0 K^\pm \pi^\mp)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^0 \pi^+ \pi^-)] = 1.70 \pm 0.07 \pm 0.15$  which we multiply by our best value  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.94 \pm 0.18) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> Used  $f_s/f_d = 0.259 \pm 0.015$ .

<sup>3</sup> AAIJ 13BP reports  $[\Gamma(B_S^0 \rightarrow K^0 K^\pm \pi^\mp)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^0 \pi^+ \pi^-)] = 1.48 \pm 0.12 \pm 0.14$  which we multiply by our best value  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.94 \pm 0.18) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

$\Gamma_{105}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.25±0.24±0.11</b>	1,2 AAIJ	14BMLHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 14BM reports  $[\Gamma(B_S^0 \rightarrow K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^*(892)^+ \pi^-)] = 1.49 \pm 0.22 \pm 0.18$  which we multiply by our best value  $B(B^0 \rightarrow K^*(892)^+ \pi^-) = (8.4 \pm 0.8) \times 10^{-6}$ . 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  $f_s/f_d = 0.259 \pm 0.015$ .

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

$\Gamma_{106}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b>16.4±3.4±2.3</b>	<sup>1</sup> AAIJ	16 LHCB	$pp$ at 7 TeV

<sup>1</sup> Measured relative to  $B^0 \rightarrow K_S^0 \pi^+ \pi^-$  using the value of  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.96 \pm 0.2) \times 10^{-5}$ .

$\Gamma(K^0 K^+ K^-)/\Gamma_{\text{total}}$   $\Gamma_{107}/\Gamma$ 

VALUE (units $10^{-7}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>12.9 \pm 6.4 \pm 0.5</math></b>	1,2,3	AAIJ	17BP LHCB	$pp$ at 7, 8 TeV

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

<34                      90                      4 AAIJ                      13BP LHCB                      Repl. by AAIJ 17BP

<sup>1</sup> AAIJ 17BP reports  $[\Gamma(B_s^0 \rightarrow K^0 K^+ K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^0 \pi^+ \pi^-)] = 0.026 \pm 0.011 \pm 0.007$  which we multiply by our best value  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.94 \pm 0.18) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> AAIJ 17BP also set the limit range  $4-25 \times 10^{-7}$  at 90% CL using the world average value  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.96 \pm 0.20) \times 10^{-5}$ .

<sup>3</sup> Used  $f_s/f_d = 0.259 \pm 0.015$ .

<sup>4</sup> AAIJ 13BP reports  $[\Gamma(B_s^0 \rightarrow K^0 K^+ K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^0 \pi^+ \pi^-)] < 0.068$  which we multiply by our best value  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = 4.94 \times 10^{-5}$ .

 $\Gamma(\bar{K}^*(892)^0 \rho^0)/\Gamma_{\text{total}}$   $\Gamma_{108}/\Gamma$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt;7.67 \times 10^{-4}</math></b>	90	1 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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

 $\Gamma(\bar{K}^*(892)^0 K^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{109}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>1.11 \pm 0.26 \pm 0.06</math></b>	1	AAIJ	15AF LHCB	$pp$ at 7 TeV

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

$2.81 \pm 0.46 \pm 0.56$                       2 AAIJ                      12F LHCB                      Repl. by AAIJ 15AF  
<168.1                      90                      3 ABE                      00C SLD                       $e^+ e^- \rightarrow Z$

<sup>1</sup> AAIJ 15AF reports  $[\Gamma(B_s^0 \rightarrow \bar{K}^*(892)^0 K^*(892)^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^*(892)^0 \phi)] = 1.11 \pm 0.22 \pm 0.12 \pm 0.06$  which we multiply by our best value  $B(B^0 \rightarrow K^*(892)^0 \phi) = (1.00 \pm 0.05) \times 10^{-5}$ . 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  $B^0 \rightarrow J/\psi K^{*0}$  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>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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

 $\Gamma(\phi K^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{110}/\Gamma$ 

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>1.14 \pm 0.29 \pm 0.06</math></b>	1	AAIJ	13BW LHCB	$pp$ at 7 TeV

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

<1013                      90                      2 ABE                      00C SLD                       $e^+ e^- \rightarrow Z$

<sup>1</sup> AAIJ 13BW reports  $[\Gamma(B_s^0 \rightarrow \phi K^*(892)^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^*(892)^0 \phi)] = 0.113 \pm 0.024 \pm 0.016$  which we multiply by our best value  $B(B^0 \rightarrow K^*(892)^0 \phi) = (1.00 \pm 0.05) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> 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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

### $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ $\Gamma_{111}/\Gamma$

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

VALUE (units $10^{-8}$ )	CL%	DOCUMENT ID	TECN	COMMENT
< <b>1.5</b>	90	<sup>1</sup> AAIJ	17BJ LHCB	$p\bar{p}$ at 7 and 8 TeV

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

$2.84^{+2.03+0.85}_{-1.68-0.18}$		<sup>2</sup> AAIJ	13BQ LHCB	Repl. by AAIJ 17BJ
<5900	90	<sup>3</sup> BUSKULIC	96V ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> Uses normalization mode  $B(B^0 \rightarrow K^+ \pi^-) = (19.6 \pm 0.5) \times 10^{-6}$  and  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.259 \pm 0.015$ .

<sup>2</sup> Uses normalization mode  $B(B^0 \rightarrow K^+ \pi^-) = (19.55 \pm 0.54) \times 10^{-6}$  and  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.256 \pm 0.020$ .

<sup>3</sup> BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.

### $\Gamma(p\bar{p}K^+K^-)/\Gamma_{\text{total}}$ $\Gamma_{112}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>4.5 \pm 0.4 \pm 0.2</math></b>	<sup>1,2</sup> AAIJ	17BD LHCB	$p\bar{p}$ at 7, 8 TeV

<sup>1</sup> AAIJ 17BD reports  $[\Gamma(B_s^0 \rightarrow p\bar{p}K^+K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)K^*(892)^0)] / [B(J/\psi(1S) \rightarrow p\bar{p})] / [B(K^*(892) \rightarrow (K\pi)^\pm)] = 1.67 \pm 0.12 \pm 0.11$  which we multiply by our best values  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.27 \pm 0.05) \times 10^{-3}$ ,  $B(J/\psi(1S) \rightarrow p\bar{p}) = (2.121 \pm 0.029) \times 10^{-3}$ ,  $B(K^*(892) \rightarrow (K\pi)^\pm) = (99.900 \pm 0.009) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values. Reported value assumes  $f_s/f_d = 0.259 \pm 0.015$ .

<sup>2</sup> The branching ratio is given for  $m_{p\bar{p}} < 2.85$  GeV.

### $\Gamma(p\bar{p}K^+\pi^-)/\Gamma_{\text{total}}$ $\Gamma_{113}/\Gamma$

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>13.9 \pm 2.5 \pm 0.5</math></b>	<sup>1,2</sup> AAIJ	17BD LHCB	$p\bar{p}$ at 7, 8 TeV

<sup>1</sup> AAIJ 17BD reports  $[\Gamma(B_s^0 \rightarrow p\bar{p}K^+\pi^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)K^*(892)^0)] / [B(J/\psi(1S) \rightarrow p\bar{p})] / [B(K^*(892) \rightarrow (K\pi)^\pm)] = 0.52 \pm 0.08 \pm 0.05$  which we multiply by our best values  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.27 \pm 0.05) \times 10^{-3}$ ,  $B(J/\psi(1S) \rightarrow p\bar{p}) = (2.121 \pm 0.029) \times 10^{-3}$ ,  $B(K^*(892) \rightarrow (K\pi)^\pm) = (99.900 \pm 0.009) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values. Reported value assumes  $f_s/f_d = 0.259 \pm 0.015$ .

<sup>2</sup> The branching ratio is given for  $m_{p\bar{p}} < 2.85$  GeV.

$\Gamma(\rho\bar{p}K^+\pi^-)/\Gamma(\rho\bar{p}K^+K^-)$   $\Gamma_{113}/\Gamma_{112}$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.31±0.05±0.02</b>	1,2 AAIJ	17BD LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Reports  $B(B_S^0 \rightarrow \rho\bar{p}K^+\pi^-) / B(B^0 \rightarrow \rho\bar{p}K^+\pi^-) = 0.22 \pm 0.04 \pm 0.02 \pm 0.01$ , where the third error is due to  $f_s/f_d$ .

<sup>2</sup> The ratio is given for  $m_{\rho\bar{p}} < 2.85$  GeV and assuming  $f_s/f_d = 0.259 \pm 0.015$ .

 $\Gamma(\rho\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{114}/\Gamma$ 

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b>4.3±2.0±0.2</b>	1,2 AAIJ	17BD LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 17BD reports  $[\Gamma(B_S^0 \rightarrow \rho\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)K^*(892)^0)] / [B(J/\psi(1S) \rightarrow \rho\bar{p})] / [B(K^*(892) \rightarrow (K\pi)^\pm)] = 0.16 \pm 0.07 \pm 0.02$  which we multiply by our best values  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.27 \pm 0.05) \times 10^{-3}$ ,  $B(J/\psi(1S) \rightarrow \rho\bar{p}) = (2.121 \pm 0.029) \times 10^{-3}$ ,  $B(K^*(892) \rightarrow (K\pi)^\pm) = (99.900 \pm 0.009) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values. Reported value assumes  $f_s/f_d = 0.259 \pm 0.015$ .

<sup>2</sup> The branching ratio is given for  $m_{\rho\bar{p}} < 2.85$  GeV.

 $\Gamma(\rho\bar{\Lambda}K^- + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{115}/\Gamma$ 

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b>5.5±0.6±0.8</b>	1,2 AAIJ	17AL LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 17AL reports  $(5.46 \pm 0.61 \pm 0.82) \times 10^{-6}$  from a measurement of  $[\Gamma(B_S^0 \rightarrow \rho\bar{\Lambda}K^- + \text{c.c.})/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \rho\bar{\Lambda}\pi^-)]$  assuming  $B(B^0 \rightarrow \rho\bar{\Lambda}\pi^-) = (3.14 \pm 0.29) \times 10^{-6}$ .

<sup>2</sup> AAIJ 17AL value represents the sum of  $B_S^0 \rightarrow \rho\bar{\Lambda}K^-$  and  $B_S^0 \rightarrow \bar{\rho}\Lambda K^+$  and assumes the fraction  $f_s/f_d = 0.259 \pm 0.015$ .

 $\Gamma(\Lambda_c^- \Lambda\pi^+)/\Gamma_{\text{total}}$   $\Gamma_{116}/\Gamma$ 

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>3.6±1.1±1.2</b>	1 SOLOVIEVA	13 BELL	$e^+e^- \rightarrow \Upsilon(4S)$

<sup>1</sup> The second error is the total systematic uncertainty including the  $\Lambda_c$  absolute branching fractions and the normalization number of  $B_S$  events.

 $\Gamma(\Lambda_c^- \Lambda_c^+)/\Gamma_{\text{total}}$   $\Gamma_{117}/\Gamma$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;8.0 × 10<sup>-5</sup></b>	95	1 AAIJ	14AA LHCB	$pp$ at 7 TeV

<sup>1</sup> Uses  $B(\bar{B}^0 \rightarrow D^+D_s^-) = (7.2 \pm 0.8) \times 10^{-3}$ .

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{118}/\Gamma$ 

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

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt; 3.1</b>	90	1 DUTTA	15 BELL	$e^+e^- \rightarrow \Upsilon(5S)$

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

< 8.7	90	2 WICHT	08A BELL	Repl. by DUTTA 15
< 53	90	DRUTSKOY	07A BELL	Repl. by WICHT 08A
< 148	90	3 ACCIARRI	95I L3	$e^+e^- \rightarrow Z$

- <sup>1</sup> Assumes the fraction of  $B_s^{(*)}\bar{B}_s^{(*)}$  in  $b\bar{b}$  events is  $f_s = (17.2 \pm 3.0)\%$ .  
<sup>2</sup> Assumes  $\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^* = (19.5^{+3.0}_{-2.3})\%$ .  
<sup>3</sup> ACCIARRI 95I assumes  $f_{B^0} = 39.5 \pm 4.0$  and  $f_{B_s} = (12.0 \pm 3.0)\%$ .

**$\Gamma(\phi\gamma)/\Gamma_{\text{total}}$**   **$\Gamma_{119}/\Gamma$**

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>34 ± 4</b>		<b>OUR AVERAGE</b>		
36 ± 5 ± 7		1 DUTTA	15 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
33.8 ± 3.4 ± 2.0		2 AAIJ	13 LHCB	$pp$ at 7 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
39 ± 5		3 AAIJ	12AE LHCB	Repl. by AAIJ 13
57 <sup>+18</sup> <sub>-15</sub> <sup>+12</sup> <sub>-11</sub>		4 WICHT	08A BELL	Repl. by DUTTA 15
<390	90	DRUTSKOY	07A BELL	$e^+e^- \rightarrow \Upsilon(5S)$
<120	90	ACOSTA	02G CDF	$p\bar{p}$ at 1.8 TeV
<700	90	5 ADAM	96D DLPH	$e^+e^- \rightarrow Z$

- <sup>1</sup> Assumes the fraction of  $B_s^{(*)}\bar{B}_s^{(*)}$  in  $b\bar{b}$  events is  $f_s = (17.2 \pm 3.0)\%$ . The systematic uncertainty from  $f_s$  is  $0.6 \times 10^{-5}$ .  
<sup>2</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  $B(B^0 \rightarrow K^*(892)^0\gamma) = (4.18 \pm 0.25) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.  
<sup>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> Assumes  $\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^* = (19.5^{+3.0}_{-2.3})\%$ .  
<sup>5</sup> ADAM 96D assumes  $f_{B^0} = f_{B^-} = 0.39$  and  $f_{B_s} = 0.12$ .

**$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$**   **$\Gamma_{120}/\Gamma$**

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

VALUE (units $10^{-9}$ )	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<b>2.7<sup>+0.6</sup><sub>-0.5</sub></b>		<b>OUR AVERAGE</b> Error includes scale factor of 1.2.		
3.0 ± 0.6 <sup>+0.3</sup> <sub>-0.2</sub>		AAIJ	17AI LHCB	$pp$ at 7, 8, 13 TeV
0.9 <sup>+1.1</sup> <sub>-0.8</sub>		1 AABOUD	16L ATLS	$pp$ at 7, 8 TeV
13 <sup>+9</sup> <sub>-7</sub>		2 AALTONEN	13F CDF	$p\bar{p}$ at 1.96 TeV
3.0 <sup>+1.0</sup> <sub>-0.9</sub>		3 CHATRCHYAN	13AW CMS	$pp$ at 7, 8 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2.8 <sup>+0.7</sup> <sub>-0.6</sub>		4 KHACHATRY...	15BE LHC	$pp$ at 7, 8 TeV
3.2 <sup>+1.4+0.5</sup> <sub>-1.2-0.3</sub>		5 AAIJ	13B LHCB	Repl. by AAIJ 13BA
2.9 <sup>+1.1+0.3</sup> <sub>-1.0-0.1</sub>		6 AAIJ	13BA LHCB	Repl. by KHACHA-TRYAN 15BE
<12	90	7 ABAZOV	13C D0	$p\bar{p}$ at 1.96 TeV
<19	90	8 AAD	12AE ATLS	$pp$ at 7 TeV
<12	90	9 AAIJ	12A LHCB	Repl. by AAIJ 12W

< 3.8	90	10	AAIJ	12W	LHCB	Repl. by AAIJ 13B
< 6.4	90	11	CHATRCHYAN	12A	CMS	$p\bar{p}$ at 7 TeV
< 43	90	12	AAIJ	11B	LHCB	Repl. by AAIJ 12A
< 35	90	13	AALTONEN	11AG	CDF	$p\bar{p}$ at 1.96 TeV
< 16	90	14	CHATRCHYAN	11T	CMS	Repl. by CHATRCHYAN 12A
< 42	90	15	ABAZOV	10S	D0	$p\bar{p}$ at 1.96 TeV

<sup>1</sup> This value corresponds to an upper limit of  $< 3.0 \times 10^{-9}$  at 95% C.L. It uses  $f_s/f_d = 0.24 \pm 0.02$ .

<sup>2</sup> Uses normalization mode  $B(B^+ \rightarrow J/\psi K^+) = (10.22 \pm 0.35) \times 10^{-4}$  and  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.28 \pm 0.04$ .

<sup>3</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  $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+ \mu^- K^+) = (6.0 \pm 0.2) \times 10^{-5}$  for normalization.

<sup>4</sup> Determined from the joint fit to CMS and LHCb data. Uncertainty includes both statistical and systematic component.

<sup>5</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>6</sup> Uses  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.259 \pm 0.015$  and normalization modes  $B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+ \mu^- K^+$  and  $B^0 \rightarrow K^+ \pi^-$ .

<sup>7</sup> Uses normalization mode  $B(B^+ \rightarrow J/\psi K^+ \rightarrow \mu^+ \mu^- K^+) = (6.01 \pm 0.21) \times 10^{-5}$  and  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.263 \pm 0.017$ .

<sup>8</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>9</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>10</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>11</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>12</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>13</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>14</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>15</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.

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

$\Gamma_{121}/\Gamma$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;2.8 × 10<sup>-7</sup></b>	90	AALTONEN 09P	CDF	$p\bar{p}$ at 1.96 TeV

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

<5.4 × 10 <sup>-5</sup>	90	<sup>1</sup> ACCIARRI 97B	L3	$e^+ e^- \rightarrow Z$
-------------------------	----	---------------------------	----	-------------------------

<sup>1</sup> ACCIARRI 97B assume PDG 96 production fractions for  $B^+$ ,  $B^0$ ,  $B_s^0$ , and  $\Lambda_b$ .

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$   $\Gamma_{122}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.8 \times 10^{-3}$	95	<sup>1</sup> AAIJ	17AJ LHCB	$p\bar{p}$ at 7, 8 TeV

<sup>1</sup> Assuming no contribution from  $B^0 \rightarrow \tau^+\tau^-$ .

$\Gamma(\mu^+\mu^-\mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_{123}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.5 \times 10^{-9}$	95	AAIJ	17N LHCB	$p\bar{p}$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<1.2 \times 10^{-8}$	90	<sup>1</sup> AAIJ	13AW LHCB	Repl. by AAIJ 17N

<sup>1</sup> Also reports a limit of  $<1.6 \times 10^{-8}$  at 95% CL.

$\Gamma(SP, S \rightarrow \mu^+\mu^-, P \rightarrow \mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_{124}/\Gamma$

Here  $S$  and  $P$  are the hypothetical scalar and pseudoscalar particles with masses of 2.5 GeV/c<sup>2</sup> and 214.3 MeV/c<sup>2</sup>, respectively.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.2 \times 10^{-9}$	95	AAIJ	17N LHCB	$p\bar{p}$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<1.2 \times 10^{-8}$	90	<sup>1</sup> AAIJ	13AW LHCB	Repl. by AAIJ 17N

<sup>1</sup> Also reports a limit of  $<1.6 \times 10^{-8}$  at 95% CL.

$\Gamma(\phi(1020)\mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_{125}/\Gamma$

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

VALUE (units $10^{-7}$ )	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<32$	90	<sup>1</sup> ABAZOV	06G D0	$\rho\bar{p}$ at 1.96 TeV
$<4.7 \times 10^2$	90	ACOSTA	02D CDF	$\rho\bar{p}$ at 1.8 TeV

<sup>1</sup> Uses  $B(B_s^0 \rightarrow J/\psi\phi) = 9.3 \times 10^{-4}$ .

$\Gamma(\phi(1020)\mu^+\mu^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{125}/\Gamma_{48}$

VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>0.76 ± 0.09 OUR AVERAGE</b>		Error includes scale factor of 1.9.		
$0.741^{+0.042}_{-0.040} \pm 0.029$		AAIJ	15AQ LHCB	$p\bar{p}$ at 7, 8 TeV
$1.13 \pm 0.19 \pm 0.07$		AALTONEN	11AI CDF	$\rho\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.674^{+0.061}_{-0.056} \pm 0.016$		<sup>1</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
$1.11 \pm 0.25 \pm 0.09$		AALTONEN	11L CDF	Repl. by AALTONEN 11AI
$<2.3$	90	AALTONEN	09B CDF	Repl. by AALTONEN 11L

<sup>1</sup> Replaced by AAIJ 15AQ.

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_{126}/\Gamma$

VALUE (units $10^{-8}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>8.4 \pm 1.6 \pm 0.3</math></b>	<sup>1</sup> AAIJ	15S	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 15S reports  $(8.6 \pm 1.5 \pm 0.7 \pm 0.7) \times 10^{-8}$  from a measurement of  $[\Gamma(B_s^0 \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)K^*(892)^0)]$  assuming  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.3 \pm 0.1) \times 10^{-3}$ , which we rescale to our best value  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.27 \pm 0.05) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\phi\nu\bar{\nu})/\Gamma_{\text{total}}$   $\Gamma_{127}/\Gamma$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 5.4 \times 10^{-3}</math></b>	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  $f_{B_s} = 0.12$ .

$\Gamma(e^\pm\mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{128}/\Gamma$

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 1.1 \times 10^{-8}</math></b>	90	<sup>1</sup> AAIJ	13BMLHCB	$pp$ at 7 TeV

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

$< 2.0 \times 10^{-7}$	90	AALTONEN	09P	CDF $p\bar{p}$ at 1.96 TeV
$< 6.1 \times 10^{-6}$	90	ABE	98V	CDF Repl. by AALTONEN 09P
$< 4.1 \times 10^{-5}$	90	<sup>2</sup> ACCIARRI	97B	L3 $e^+e^- \rightarrow Z$

<sup>1</sup> Uses normalization mode  $B(B^0 \rightarrow K^+\pi^-) = (19.4 \pm 0.6) \times 10^{-6}$  and  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.256 \pm 0.020$ .

<sup>2</sup> ACCIARRI 97B assume PDG 96 production fractions for  $B^+$ ,  $B^0$ ,  $B_s$ , and  $\Lambda_b$ .

## POLARIZATION IN $B_s^0$ DECAY

In decays involving two vector mesons, one can distinguish among the states in which meson polarizations are both longitudinal ( $L$ ), or both are transverse and parallel ( $\parallel$ ), or perpendicular ( $\perp$ ) to each other with the parameters  $\Gamma_L/\Gamma$ ,  $\Gamma_\perp/\Gamma$ , and the relative phases  $\phi_\parallel$  and  $\phi_\perp$ . See the definitions in the note on "Polarization in  $B$  Decays" review in the  $B^0$  Particle Listings.

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>1.05^{+0.08+0.03}_{-0.10-0.04}</math></b>	LOUVOT	10	BELL $e^+e^- \rightarrow \Upsilon(5S)$

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.523 \pm 0.005</math> OUR AVERAGE</b>	Error includes scale factor of 1.1.		
$0.522 \pm 0.003 \pm 0.007$	<sup>1</sup> AAD	16AP	ATLS $pp$ at 7, 8 TeV
$0.510 \pm 0.005 \pm 0.011$	KHACHATRY...		16S CMS $pp$ at 8 TeV
$0.5241 \pm 0.0034 \pm 0.0067$	AAIJ	15I	LHCB $pp$ at 7, 8 TeV
$0.524 \pm 0.013 \pm 0.015$	<sup>2</sup> AALTONEN	12D	CDF $p\bar{p}$ at 1.96 TeV



0.558	$\begin{matrix} +0.017 \\ -0.019 \end{matrix}$		<sup>2,3</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV
0.61	$\pm 0.14 \pm 0.02$		<sup>4</sup> AFFOLDER	00N CDF	$p\bar{p}$ at 1.8 TeV
0.56	$\pm 0.21 \begin{matrix} +0.02 \\ -0.04 \end{matrix}$		ABE	95Z CDF	$p\bar{p}$ at 1.8 TeV

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

0.529	$\pm 0.006 \pm 0.012$	<sup>1</sup> AAD	14U ATLS	Repl. by AAD 16AP
0.539	$\pm 0.014 \pm 0.016$	<sup>2</sup> AAD	12CV ATLS	Repl. by AAD 14U
0.555	$\pm 0.027 \pm 0.006$	<sup>5</sup> ABAZOV	09E D0	Repl. by ABAZOV 12D
0.531	$\pm 0.020 \pm 0.007$	<sup>2</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 flavor tagged, time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>2</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>3</sup> The error includes both statistical and systematic uncertainties.

<sup>4</sup> AFFOLDER 00N measurements are based on 40  $B_s^0$  candidates obtained from a data sample of  $89 \text{ pb}^{-1}$ . The  $P$ -wave fraction is found to be  $0.23 \pm 0.19 \pm 0.04$ .

<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  $B_s^0 \rightarrow J/\psi\phi$ .

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.06 \begin{matrix} +0.18 \\ -0.17 \end{matrix} \pm 0.03</math></b>	ESEN	13	BELL $e^+e^- \rightarrow \Upsilon(5S)$

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.228 \pm 0.007</math> OUR AVERAGE</b>			
$0.227 \pm 0.004 \pm 0.006$	<sup>1</sup> AAD	16AP ATLS	$pp$ at 7, 8 TeV
$0.231 \pm 0.014 \pm 0.015$	<sup>2</sup> AALTONEN	12D CDF	$p\bar{p}$ at 1.96 TeV
$0.231 \begin{matrix} +0.024 \\ -0.030 \end{matrix}$	<sup>2,3</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV

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

$0.220 \pm 0.008 \pm 0.009$	<sup>1</sup> AAD	14U ATLS	Repl. by AAD 16AP
$0.224 \pm 0.010 \pm 0.009$	<sup>2</sup> AAD	12CV ATLS	Repl. by AAD 14U
$0.244 \pm 0.032 \pm 0.014$	<sup>4</sup> ABAZOV	09E D0	Repl. by ABAZOV 12D
$0.230 \pm 0.029 \pm 0.011$	<sup>2</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 a tagged, time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>2</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>3</sup> The error includes both statistical and systematic uncertainties.

<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  $B_s^0 \rightarrow J/\psi\phi$ .

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.249 \pm 0.006</math> OUR AVERAGE</b>			
$0.243 \pm 0.008 \pm 0.012$	KHACHATRY...16S	CMS	$pp$ at 8 TeV
$0.2504 \pm 0.0049 \pm 0.0036$	AAIJ	15l LHCb	$pp$ at 7, 8 TeV

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

<u>VALUE (rad)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3.19<sup>+0.08</sup><sub>-0.09</sub> OUR AVERAGE</b>			
3.15±0.10±0.05	AAD	16AP ATLS	$pp$ at 7, 8 TeV
3.48 <sup>+0.07</sup> <sub>-0.09</sub> ±0.68	KHACHATRY...16S	CMS	$pp$ at 8 TeV
3.26 <sup>+0.10</sup> <sub>-0.17</sub> <sup>+0.06</sup> <sub>-0.07</sub>	AAIJ	15i LHCB	$pp$ at 7, 8 TeV
3.15±0.22	<sup>1</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2.72 <sup>+1.12</sup> <sub>-0.27</sub> ±0.26	ABAZOV	09E D0	Repl. by ABAZOV 12D

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

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

<u>VALUE (rad)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3.2 ±0.4 OUR AVERAGE</b> Error includes scale factor of 2.8.			
4.15±0.32±0.16	<sup>1</sup> AAD	16AP ATLS	$pp$ at 7, 8 TeV
2.98±0.36±0.66	KHACHATRY...16S	CMS	$pp$ at 8 TeV
3.08 <sup>+0.14</sup> <sub>-0.15</sub> ±0.06	AAIJ	15i LHCB	$pp$ at 7, 8 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
3.89±0.47±0.11	<sup>1</sup> AAD	14U ATLS	Repl. by AAD 16AP

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

$\Gamma_{\perp}/\Gamma$  in  $B_s^0 \rightarrow \psi(2S)\phi$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.264<sup>+0.024</sup><sub>-0.023</sub>±0.002</b>	<sup>1</sup> AAIJ	16AK LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow \psi(2S)\phi$  decays.

$\phi_{\parallel}$  in  $B_s^0 \rightarrow \psi(2S)\phi$

<u>VALUE (rad)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3.67<sup>+0.13</sup><sub>-0.18</sub>±0.03</b>	<sup>1</sup> AAIJ	16AK LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow \psi(2S)\phi$  decays.

$\phi_{\perp}$  in  $B_s^0 \rightarrow \psi(2S)\phi$

<u>VALUE (rad)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3.29<sup>+0.43</sup><sub>-0.39</sub>±0.04</b>	<sup>1</sup> AAIJ	16AK LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow \psi(2S)\phi$  decays.

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.497 \pm 0.025 \pm 0.025</math></b>	AAIJ	15AV LHCB	$pp$ at 7, 8 TeV

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

$0.50 \pm 0.08 \pm 0.02$	<sup>1</sup> AAIJ	12AP LHCB	Repl. by AAIJ 15AV
--------------------------	-------------------	-----------	--------------------

<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  $B_s^0 \rightarrow J/\psi(1S)\bar{K}^*(892)^0$ 

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.179 \pm 0.027 \pm 0.013</math></b>	AAIJ	15AV LHCB	$pp$ at 7, 8 TeV

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

$0.19^{+0.10}_{-0.08} \pm 0.02$	<sup>1</sup> AAIJ	12AP LHCB	Repl. by AAIJ 15AV
---------------------------------	-------------------	-----------	--------------------

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

 $\Gamma_{\parallel}/\Gamma$  of  $K^*(892)^0$  in  $B_s^0 \rightarrow \psi(2S)\bar{K}^*(892)^0$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.524 \pm 0.056 \pm 0.029</math></b>	AAIJ	15U LHCB	$pp$ at 7, 8 TeV

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.362 \pm 0.014</math> OUR AVERAGE</b>			

$0.364 \pm 0.012 \pm 0.009$	AAIJ	14AE LHCB	$pp$ at 7, 8 TeV
-----------------------------	------	-----------	------------------

$0.348 \pm 0.041 \pm 0.021$	AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV
-----------------------------	----------	----------	------------------------

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

$0.365 \pm 0.022 \pm 0.012$	AAIJ	12P LHCB	Repl. by AAIJ 14AE
-----------------------------	------	----------	--------------------

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.309 \pm 0.015</math> OUR AVERAGE</b>			Error includes scale factor of 1.1.

$0.305 \pm 0.013 \pm 0.005$	AAIJ	14AE LHCB	$pp$ at 7, 8 TeV
-----------------------------	------	-----------	------------------

$0.365 \pm 0.044 \pm 0.027$	AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV
-----------------------------	----------	----------	------------------------

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

$0.291 \pm 0.024 \pm 0.010$	AAIJ	12P LHCB	Repl. by AAIJ 14AE
-----------------------------	------	----------	--------------------

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

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
<b><math>2.55 \pm 0.11</math> OUR AVERAGE</b>			

$2.54 \pm 0.07 \pm 0.09$	<sup>1</sup> AAIJ	14AE LHCB	$pp$ at 7, 8 TeV
--------------------------	-------------------	-----------	------------------

$2.71^{+0.31}_{-0.36} \pm 0.22$	<sup>2</sup> AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV
---------------------------------	-----------------------	----------	------------------------

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

$2.57 \pm 0.15 \pm 0.06$	<sup>3</sup> AAIJ	12P LHCB	Repl. by AAIJ 14AE
--------------------------	-------------------	----------	--------------------

<sup>1</sup> AAIJ 14AE reports measurement of  $\phi_{\perp}$  and  $\phi_{\perp} - \phi_{\parallel}$ , which we convert into  $\phi_{\parallel}$ . Statistical uncertainty includes correlation between measured parameters, while systematic uncertainties are assumed uncorrelated.

<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.

<sup>3</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.

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

<u>VALUE (rad)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2.67±0.23±0.07</b>	AAIJ	14AE LHCB	$pp$ at 7, 8 TeV

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.201±0.057±0.040</b>	<sup>1</sup> AAIJ	15AF LHCB	$pp$ at 7 TeV

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

0.31 ±0.12 ±0.04      AAIJ      12F LHCB      Repl. by AAIJ 15AF

<sup>1</sup> Measured in angular analysis, which takes into account  $S$ -wave contributions.

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

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

### $\Gamma_{\parallel}/\Gamma$ in $B_s^0 \rightarrow K^{*}(892)^0\bar{K}^{*}(892)^0$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.215±0.046±0.015</b>	AAIJ	15AF LHCB	$pp$ at 7 TeV

### $\Phi_{\parallel}$ in $B_s^0 \rightarrow K^{*}(892)^0\bar{K}^{*}(892)^0$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>5.31±0.24±0.14</b>	AAIJ	15AF LHCB	$pp$ at 7 TeV

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.51±0.15±0.07</b>	AAIJ	13BW LHCB	$pp$ at 7 TeV

### $\Gamma_{\parallel}/\Gamma$ in $B_s^0 \rightarrow \phi\bar{K}^{*0}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.21±0.11±0.02</b>	AAIJ	13BW LHCB	$pp$ at 7 TeV

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

<u>VALUE (rad)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.75±0.53±0.29</b>	<sup>1</sup> AAIJ	13BW LHCB	$pp$ at 7 TeV

<sup>1</sup> Measures  $\cos(\phi_{\parallel}) = -0.18 \pm 0.52 \pm 0.29$ , which we convert to  $\phi_{\parallel}$  by taking the smaller solution.

**$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $0.10 < q^2 < 2.00 \text{ GeV}^2/c^4$ )**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.20^{+0.08}_{-0.09} \pm 0.02$	AAIJ	15AQ LHCB	$p p$ at 7, 8 TeV

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

$0.37^{+0.19}_{-0.17} \pm 0.07$	AAIJ	13X LHCB	Repl. by AAIJ 15AQ
---------------------------------	------	----------	--------------------

 **$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $2.00 < q^2 < 5.0 \text{ GeV}^2/c^4$ )**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.68^{+0.16}_{-0.13} \pm 0.03$	AAIJ	15AQ LHCB	$p p$ at 7, 8 TeV

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

$0.53^{+0.25}_{-0.23} \pm 0.10$	<sup>1</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
---------------------------------	-------------------	----------	--------------------

<sup>1</sup> Measured in  $2.0 < q^2 < 4.3 \text{ GeV}^2/c^4$ .

 **$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $5.0 < q^2 < 8.0 \text{ GeV}^2/c^4$ )**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.54^{+0.10}_{-0.09} \pm 0.02$	AAIJ	15AQ LHCB	$p p$ at 7, 8 TeV

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

$0.81^{+0.11}_{-0.13} \pm 0.05$	<sup>1</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
---------------------------------	-------------------	----------	--------------------

<sup>1</sup> Measured in  $4.3 < q^2 < 8.68 \text{ GeV}^2/c^4$ .

 **$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $11.0 < q^2 < 12.5 \text{ GeV}^2/c^4$ )**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.29 \pm 0.11 \pm 0.04$	AAIJ	15AQ LHCB	$p p$ at 7, 8 TeV

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

$0.33^{+0.14}_{-0.12} \pm 0.06$	<sup>1</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
---------------------------------	-------------------	----------	--------------------

<sup>1</sup> Measured in  $10.09 < q^2 < 12.90 \text{ GeV}^2/c^4$ .

 **$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $15.0 < q^2 < 17.0 \text{ GeV}^2/c^4$ )**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.23^{+0.09}_{-0.08} \pm 0.02$	AAIJ	15AQ LHCB	$p p$ at 7, 8 TeV

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

$0.34^{+0.18}_{-0.17} \pm 0.07$	<sup>1</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
---------------------------------	-------------------	----------	--------------------

<sup>1</sup> Measured in  $14.18 < q^2 < 16 \text{ GeV}^2/c^4$ .

 **$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $17.0 < q^2 < 19.0 \text{ GeV}^2/c^4$ )**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.40^{+0.13}_{-0.15} \pm 0.02$	AAIJ	15AQ LHCB	$p p$ at 7, 8 TeV

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

$0.16^{+0.17}_{-0.10} \pm 0.07$	<sup>1</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
---------------------------------	-------------------	----------	--------------------

<sup>1</sup> Measured in  $16.0 < q^2 < 19.0 \text{ GeV}^2/c^4$ .

**$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $1.00 < q^2 < 6.00 \text{ GeV}^2/c^4$ )**

VALUE	DOCUMENT ID	TECN	COMMENT
$0.63^{+0.09}_{-0.09} \pm 0.03$	AAIJ	15AQ LHCb	$pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.56^{+0.17}_{-0.16} \pm 0.09$	AAIJ	13X LHCb	Repl. by AAIJ 15AQ

**$B_s^0-\bar{B}_s^0$  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 (HFLAV) by taking into account correlations between measurements.

VALUE ( $10^{12} \text{ } \hbar \text{ s}^{-1}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>17.757 ± 0.021 OUR EVALUATION</b>				
<b>17.756 ± 0.021 OUR AVERAGE</b>				
$17.711^{+0.055}_{-0.057} \pm 0.011$	1	AAIJ	15I LHCb	$pp$ at 7, 8 TeV
$17.768 \pm 0.023 \pm 0.006$	2	AAIJ	13BI LHCb	$pp$ at 7 TeV
$17.93 \pm 0.22 \pm 0.15$	3	AAIJ	13CF LHCb	$pp$ at 7 TeV
$17.63 \pm 0.11 \pm 0.02$	4	AAIJ	12I LHCb	$pp$ at 7 TeV
$17.77 \pm 0.10 \pm 0.07$	5	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	6 ABAZOV	06B D0	$p\bar{p}$ at 1.96 TeV
$17.31^{+0.33}_{-0.18} \pm 0.07$	7	ABULENCIA	06Q CDF	Repl. by ABULENCIA,A 06G
> 8.0	95	8 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 4.9	95	9 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$

> 8.5	95	10	ABDALLAH	04J	DLPH	$e^+e^- \rightarrow Z^0$
> 5.0	95	11	ABDALLAH	03B	DLPH	$e^+e^- \rightarrow Z$
>10.3	95	12	ABE	03	SLD	$e^+e^- \rightarrow Z$
>10.9	95	13	HEISTER	03E	ALEP	$e^+e^- \rightarrow Z$
> 5.3	95	14	ABE	02V	SLD	$e^+e^- \rightarrow Z$
> 1.0	95	15	ABBIENDI	01D	OPAL	$e^+e^- \rightarrow Z$
> 7.4	95	16	ABREU	00Y	DLPH	Repl. by ABDALLAH 04J
> 4.0	95	17	ABREU,P	00G	DLPH	$e^+e^- \rightarrow Z$
> 5.2	95	18	ABBIENDI	99S	OPAL	$e^+e^- \rightarrow Z$
<96	95	19	ABE	99D	CDF	$p\bar{p}$ at 1.8 TeV
> 5.8	95	20	ABE	99J	CDF	$p\bar{p}$ at 1.8 TeV
> 9.6	95	21	BARATE	99J	ALEP	$e^+e^- \rightarrow Z$
> 7.9	95	22	BARATE	98C	ALEP	Repl. by BARATE 99J
> 3.1	95	23	ACKERSTAFF	97U	OPAL	Repl. by ABBIENDI 99S
> 2.2	95	24	ACKERSTAFF	97V	OPAL	Repl. by ABBIENDI 99S
> 6.5	95	25	ADAM	97	DLPH	Repl. by ABREU 00Y
> 6.6	95	26	BUSKULIC	96M	ALEP	Repl. by BARATE 98C
> 2.2	95	24	AKERS	95J	OPAL	Sup. by ACKERSTAFF 97V
> 5.7	95	27	BUSKULIC	95J	ALEP	$e^+e^- \rightarrow Z$
> 1.8	95	24	BUSKULIC	94B	ALEP	$e^+e^- \rightarrow Z$

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

<sup>2</sup> Measured using  $B_s^0 \rightarrow D_s^- \pi^+$  decays.

<sup>3</sup> Measured using  $B_s^0 \rightarrow D_s^- \mu^+ \nu_\mu X$  decays.

<sup>4</sup> Measured using  $B_s^0 \rightarrow D_s^- \pi^+$  and  $D_s^- \pi^+ \pi^- \pi^+$  decays.

<sup>5</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>6</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>7</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>8</sup> Uses leptons emitted with large momentum transverse to a jet and improved techniques for vertexing and flavor-tagging.

<sup>9</sup> Updates of  $D_s$ -lepton analysis.

<sup>10</sup> Combined results from all Delphi analyses.

<sup>11</sup> Events with a high transverse momentum lepton were removed and an inclusively reconstructed vertex was required.

<sup>12</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>13</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>14</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>15</sup> Uses fully or partially reconstructed  $D_s \ell$  vertices and a mixing tag as a flavor tagging.

<sup>16</sup> Replaced by ABDALLAH 04A. Uses  $D_s^- \ell^+$ , and  $\phi \ell^+$  vertices, and a multi-variable discriminant as a flavor tagging.

- 17 Uses inclusive  $D_s$  vertices and fully reconstructed  $B_s$  decays and a multi-variable discriminant as a flavor tagging.
- 18 Uses  $l$ - $Q_{\text{hem}}$  and  $l$ - $l$ .
- 19 ABE 99D assumes  $\tau_{B_s^0} = 1.55 \pm 0.05$  ps and  $\Delta\Gamma/\Delta m = (5.6 \pm 2.6) \times 10^{-3}$ .
- 20 ABE 99J uses  $\phi$   $l$ - $l$  correlation.
- 21 BARATE 99J uses combination of an inclusive lepton and  $D_s^-$ -based analyses.
- 22 BARATE 98C combines results from  $D_s h$ - $l/Q_{\text{hem}}$ ,  $D_s h$ - $K$  in the same side,  $D_s l$ - $l/Q_{\text{hem}}$  and  $D_s l$ - $K$  in the same side.
- 23 Uses  $l$ - $Q_{\text{hem}}$ .
- 24 Uses  $l$ - $l$ .
- 25 ADAM 97 combines results from  $D_s l$ - $Q_{\text{hem}}$ ,  $l$ - $Q_{\text{hem}}$ , and  $l$ - $l$ .
- 26 BUSKULIC 96M uses  $D_s$  lepton correlations and lepton, kaon, and jet charge tags.
- 27 BUSKULIC 95J uses  $l$ - $Q_{\text{hem}}$ . 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 (HFLAV) from the results on  $\Delta m_{B_s^0}$  and "OUR EVALUATION" of the  $B_s^0$  mean lifetime.

VALUE DOCUMENT ID  
**26.72±0.09 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  
**0.499304±0.000005 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.

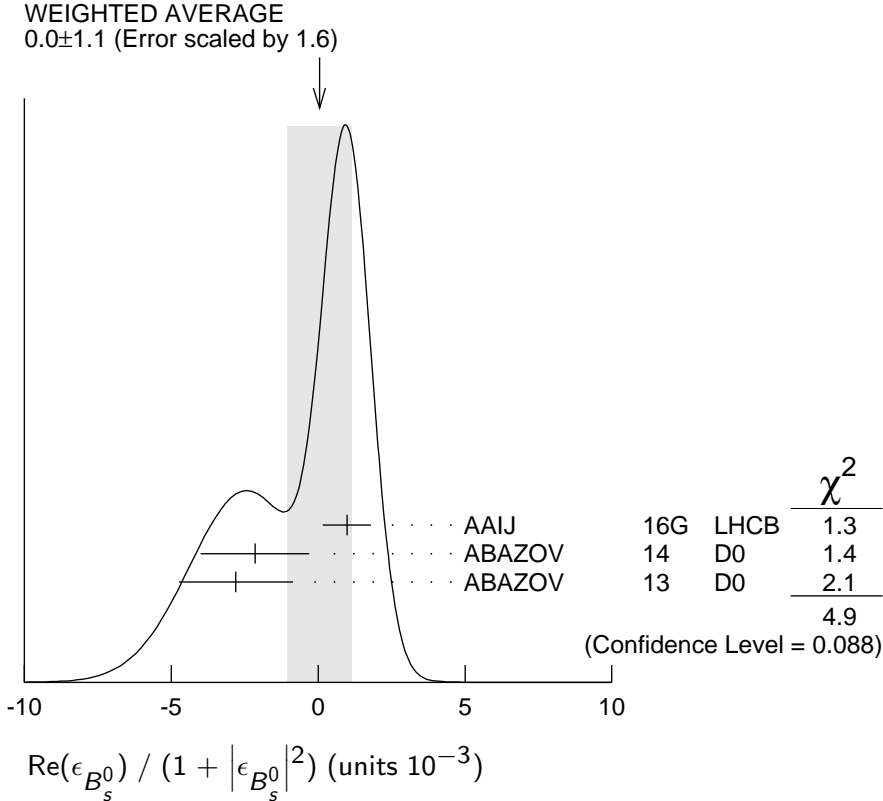
"OUR EVALUATION" is an average obtained by the Heavy Flavor Averaging Group (HFLAV) and described at <http://www.slac.stanford.edu/xorg/hflav/>. It is the result of a fit to  $B_d$  and  $B_s$  CP asymmetries, which includes the  $B_s$  measurements listed below and the  $B_d$  measurements listed in the  $B_d$  section, and takes into account correlations between those measurements.

<u>VALUE (units <math>10^{-3}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>-0.15±0.70 OUR EVALUATION</b>			
<b>0.0 ±1.1 OUR AVERAGE</b>	Error includes scale factor of 1.6. See the ideogram below.		
0.98±0.65±0.5	<sup>1</sup> AAIJ	16G	LHCB $p\bar{p}$ at 7, 8 TeV
-2.15±1.85	<sup>2</sup> ABAZOV	14	D0 $p\bar{p}$ at 1.96 TeV
-2.8 ±1.9 ±0.4	<sup>3</sup> ABAZOV	13	D0 $p\bar{p}$ at 1.96 TeV



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

$-0.15 \pm 1.25 \pm 0.90$	4 AAIJ	14D LHCB	Repl. by AAIJ 16G
$-4.5 \pm 2.7$	5 ABAZOV	11U D0	Repl. by ABAZOV 14
$-0.4 \pm 2.3 \pm 0.4$	6 ABAZOV	10E D0	Repl. by ABAZOV 13
$-3.6 \pm 1.9$	7 ABAZOV	10H D0	Repl. by ABAZOV 11U
$6.1 \pm 4.8 \pm 0.9$	8 ABAZOV	07A D0	Repl. by ABAZOV 10E



- <sup>1</sup> AAIJ 16G reports a measurement of time-integrated flavor-specific asymmetry in  $B_s^0 \rightarrow \mu^+ D_s^- X$  decays,  $A_{SL}^s = (0.39 \pm 0.26 \pm 0.20)\%$ , which is approximately equal to  $4 \times \text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2)$ .
- <sup>2</sup> ABAZOV 14 uses the dimuon charge asymmetry with different impact parameters from which it reports  $A_{SL}^s = (-0.86 \pm 0.74) \times 10^{-2}$ .
- <sup>3</sup> ABAZOV 13 reports a measurement of time-integrated flavor-specific asymmetry in mixed semileptonic  $B_s^0 \rightarrow \mu^+ D_s^- X$  decays  $A_{SL}^s = (-1.12 \pm 0.74 \pm 0.17)\%$  which is approximately equal to  $4 \times \text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2)$ .
- <sup>4</sup> AAIJ 14D reports a measurement of time-integrated flavor-specific asymmetry in  $B_s^0 \rightarrow \mu^+ D_s^- X$  decays,  $A_{SL}^s = (-0.06 \pm 0.50 \pm 0.36)\%$ , which is approximately equal to  $4 \times \text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2)$ .
- <sup>5</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>6</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>7</sup> ABAZOV 10H reports a measurement of like-sign dimuon charge asymmetry of  $A_{SL}^s = (-9.57 \pm 2.51 \pm 1.46) \times 10^{-3}$  in semileptonic  $b$ -hadron decays. Using the measured production ratio of  $B_d^0$  and  $B_s^0$ , and the asymmetry of  $B_d^0$   $A_{SL}^s = (-4.7 \pm 4.6) \times 10^{-3}$  measured from  $B$ -factories, they obtain the asymmetry for  $B_s^0$ .

<sup>8</sup> The first direct measurement of the time integrated flavor untagged charge asymmetry in semileptonic  $B_s^0$  decays is reported as  $2 \times A_{SL}^s(\text{untagged}) = A_{SL}^s = (2.45 \pm 1.93 \pm 0.35) \times 10^{-2}$ .

### $C_{KK}(B_s^0 \rightarrow K^+ K^-)$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.14 \pm 0.11 \pm 0.03</math></b>	AAIJ	13BO LHCB	$pp$ at 7 TeV

### $S_{KK}(B_s^0 \rightarrow K^+ K^-)$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.30 \pm 0.12 \pm 0.04</math></b>	AAIJ	13BO LHCB	$pp$ at 7 TeV

### $r_B(B_s^0 \rightarrow D_s^\mp K^\pm)$

$r_B$  and  $\delta_B$  are the amplitude ratio and relative strong phase between the amplitudes of  $A(B_s^0 \rightarrow D_s^+ K^-)$  and  $A(B_s^0 \rightarrow D_s^- K^+)$ ,

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.53_{-0.16}^{+0.17}</math></b>	<sup>1</sup> AAIJ	14BF LHCB	$pp$ at 7 TeV

<sup>1</sup> Measured in  $B_s^0 \rightarrow D_s^\mp K^\pm$  decays, constraining  $-2\beta_s$  by the measurement of  $\phi_s = 0.01 \pm 0.07 \pm 0.0$  from AAIJ 13AR. At 68% CL.

### $\delta_B(B_s^0 \rightarrow D_s^\pm K^\mp)$

VALUE ( $^\circ$ )	DOCUMENT ID	TECN	COMMENT
<b><math>3_{-20}^{+19}</math></b>	<sup>1</sup> AAIJ	14BF LHCB	$pp$ at 7 TeV

<sup>1</sup> Measured in  $B_s^0 \rightarrow D_s^\mp K^\pm$  decays, constraining  $-2\beta_s$  by the measurement of  $\phi_s = 0.01 \pm 0.07 \pm 0.0$  from AAIJ 13AR. The value is modulo  $180^\circ$  at 68% CL.

### 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 driven by the  $b \rightarrow c \bar{c} s$  transition (such as  $B_s \rightarrow J/\psi \phi$ ,  $J/\psi K^+ K^-$ ,  $J/\psi \pi^+ \pi^-$ , and  $D_s^+ D_s^-$ ). The Standard Model value of  $\beta_s$  is  $\arg(-\frac{V_{ts} V_{tb}^*}{V_{cs} V_{cb}^*})$  if penguin contributions are neglected.

"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 (HFLAV) and are described at <http://www.slac.stanford.edu/xorg/hflav/>. The averaging/scaling procedure takes into account correlation between the measurements.

VALUE ( $10^{-2}$ rad)	DOCUMENT ID	TECN	COMMENT
<b>1.1 ± 1.6</b>	<b>OUR EVALUATION</b>		
<b>1.8 ± 1.7</b>	<b>OUR AVERAGE</b>		
11.9 ± 10.7 ± 3.4	<sup>1</sup> AAIJ	17V LHCb	$\rho\rho$ at 7, 8 TeV
4.5 ± 3.9 ± 2.1	<sup>2</sup> AAD	16AP ATLS	$\rho\rho$ at 7, 8 TeV
-11.5 $\begin{smallmatrix} +14 \\ -14.5 \end{smallmatrix}$ ± 1	<sup>3</sup> AAIJ	16AK LHCb	$\rho\rho$ at 7, 8 TeV
3.75 ± 4.85 ± 1.55	<sup>4</sup> KHACHATRYAN 16S	CMS	$\rho\rho$ at 8 TeV
2.9 ± 2.5 ± 0.3	<sup>5</sup> AAIJ	15I LHCb	$\rho\rho$ at 7, 8 TeV
- 1 ± 9 ± 1	<sup>6</sup> AAIJ	14AY LHCb	$\rho\rho$ at 7, 8 TeV
- 3.5 ± 3.4 ± 0.4	<sup>7</sup> AAIJ	14S LHCb	$\rho\rho$ at 7, 8 TeV
	<sup>8</sup> AALTONEN	12AJ CDF	$\rho\bar{p}$ at 1.96 TeV
28 $\begin{smallmatrix} +18 \\ -19 \end{smallmatrix}$	<sup>9</sup> ABAZOV	12D D0	$\rho\bar{p}$ at 1.96 TeV

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

6 $\begin{smallmatrix} + 8 \\ - 7 \end{smallmatrix}$	<sup>10,11</sup> AAIJ	15K LHCb	$\rho\rho$ at 7, 8 TeV
- 6 ± 13 ± 3	<sup>12</sup> AAD	14U ATLS	Repl. by AAD 16AP
-17 ± 15 ± 3	<sup>13</sup> AAIJ	14AE LHCb	$\rho\rho$ at 7, 8 TeV
- 0.5 ± 3.5 ± 0.5	<sup>14</sup> AAIJ	13AR LHCb	Repl. by AAIJ 15I
	<sup>15</sup> AAIJ	13AY LHCb	$\rho\rho$ at 7 TeV
-11.0 ± 20.5 ± 5.0	<sup>16</sup> AAD	12CV ATLS	Repl. by AAD 14U
22 ± 22 ± 1	<sup>17</sup> AAIJ	12B LHCb	Repl. by AAIJ 12Q
- 8 ± 9 ± 3	<sup>18</sup> AAIJ	12D LHCb	Repl. by AAIJ 13AR
0.95 $\begin{smallmatrix} + 8.70 + 0.15 \\ - 8.65 - 0.20 \end{smallmatrix}$	<sup>19</sup> AAIJ	12Q LHCb	Repl. by AAIJ 13AR
	<sup>20</sup> AALTONEN	12D CDF	Repl. by AALTONEN 12AJ
	<sup>21</sup> AALTONEN	08G CDF	Repl. by AALTONEN 12D
28 $\begin{smallmatrix} +12 & +4 \\ -15 & -1 \end{smallmatrix}$	<sup>9,22</sup> ABAZOV	08AMD0	Repl. by ABAZOV 12D
39.5 ± 28.0 $\begin{smallmatrix} +0.5 \\ -7.0 \end{smallmatrix}$	<sup>23,24</sup> ABAZOV	07 D0	Repl. by ABAZOV 07N
35 $\begin{smallmatrix} +20 \\ -24 \end{smallmatrix}$	<sup>24,25</sup> ABAZOV	07N D0	Repl. by ABAZOV 08AM

<sup>1</sup> Measured using time-dependent angular analysis of  $B_S^0 \rightarrow J/\psi K^+ K^-$  in the region  $m(KK) > 1.05$  GeV.

<sup>2</sup> AAD 16AP reports  $\phi_s = -2\beta_s = -0.090 \pm 0.078 \pm 0.041$  rad. that was measured using a time-dependent angular analysis of  $B_S^0 \rightarrow J/\psi\phi$  decays.

<sup>3</sup> AAIJ 16AK reports  $\phi_s = -2\beta_s = 0.23 \begin{smallmatrix} +0.29 \\ -0.28 \end{smallmatrix} \pm 0.02$  rad. that was measured using a time-dependent angular analysis of  $B_S^0 \rightarrow \psi(2S)\phi$  decays.

<sup>4</sup> KHACHATRYAN 16S reports  $\phi_s = -2\beta_s = -0.075 \pm 0.097 \pm 0.031$  rad. that was measured using a time-dependent angular analysis of  $B_S^0 \rightarrow J/\psi\phi$  decays.

<sup>5</sup> AAIJ 15I reports  $\phi_s = -2\beta_s = -0.058 \pm 0.049 \pm 0.006$  rad. that was measured using a time-dependent angular analysis of  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays. It also combines this result with that of AAIJ 14S and quotes  $\phi_s = -2\beta_s = -0.010 \pm 0.039$  rad.

<sup>6</sup> AAIJ 14AY reports  $\phi_s = -2\beta_s = 0.02 \pm 0.17 \pm 0.02$  rad. in a time-dependent fit to  $B_S^0 \rightarrow D_S^+ D_S^-$ , while allowing  $CP$  violation in decay.

<sup>7</sup> AAIJ 14S reports  $\phi_s = -2\beta_s = 0.070 \pm 0.068 \pm 0.008$  rad. and  $|\lambda| = 0.89 \pm 0.05 \pm 0.01$ , when direct  $CP$  violation is allowed. Measured using a time-dependent fit to  $B_S^0 \rightarrow J/\psi\pi^+\pi^-$  decays.

- <sup>8</sup> AALTONEN 12AJ reports  $-\pi/2 < \beta_s < -1.51$  or  $-0.06 < \beta_s < 0.30$ , or  $1.26 < \beta_s < \pi/2$  rad. at 68% CL. Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.
- <sup>9</sup> ABAZOV 12D reports  $\phi_s = -2 \beta_s = -0.55^{+0.38}_{-0.36}$  rad. that was measured using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays. A single error includes both statistical and systematic uncertainties.
- <sup>10</sup> AAIJ 15K reports  $-2\beta_s = -0.12^{+0.14}_{-0.16}$  rad. The value was obtained by measuring time-dependent  $CP$  asymmetry in  $B_s^0 \rightarrow K^+ K^-$  and using a U-spin relation between  $B_s^0 \rightarrow K^+ K^-$  and  $B^0 \rightarrow \pi^+ \pi^-$ .
- <sup>11</sup> Results are also presented using additional inputs on  $B^0 \rightarrow \pi^0 \pi^0$  and  $B^+ \rightarrow \pi^+ \pi^0$  decays from other experiments and isospin symmetry assumptions. The dependence of the results on the maximum allowed amount of U-spin breaking up to 50% is also included.
- <sup>12</sup> AAD 14U reports  $\phi_s = -2 \beta_s = 0.12 \pm 0.25 \pm 0.05$  rad. that was measured using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.
- <sup>13</sup> Measured in  $B_s^0 \rightarrow \phi \phi$  decays. This is a  $b \rightarrow s \bar{s} s$  transition with a decay amplitude phase different from that of  $b \rightarrow c \bar{c} s$  transition.
- <sup>14</sup> AAIJ 13AR reports  $\phi_s = -2\beta_s = 0.01 \pm 0.07 \pm 0.01$  rad. obtained from combined fit to  $B_s^0 \rightarrow J/\psi K^+ K^-$  and  $B_s^0 \rightarrow J/\psi \pi^+ \pi^-$  data sets. Also reports separate results of  $\phi_s = 0.07 \pm 0.09 \pm 0.01$  rad. from  $B_s^0 \rightarrow J/\psi K^+ K^-$  decays and  $\phi_s = -0.14^{+0.17}_{-0.16} \pm 0.01$  rad. from  $B_s^0 \rightarrow J/\psi \pi^+ \pi^-$  decays.
- <sup>15</sup> AAIJ 13AY uses  $B_s^0 \rightarrow \phi \phi$  mode, and reports the 68% CL interval of  $\phi_s = -2 \beta_s$  as  $[-2.46, -0.76]$  rad.
- <sup>16</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>17</sup> Reports  $\phi_s = -2 \beta_s = -0.44 \pm 0.44 \pm 0.02$  rad. that was measured using a time-dependent fit to  $B_s^0 \rightarrow J/\psi f_0(980)$  decays.
- <sup>18</sup> Reports  $\phi_s = -2 \beta_s = 0.15 \pm 0.18 \pm 0.06$  rad. that was measured using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.
- <sup>19</sup> Reports  $\phi_s = -2 \beta_s = -0.019^{+0.173+0.004}_{-0.174-0.003}$  rad. 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>20</sup> Reports  $0.02 < \phi_s < 0.52$  or  $1.08 < \phi_s < 1.55$  rad. 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>21</sup> Reports  $0.32 < 2\beta_s < 2.82$  rad. 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>22</sup> Reports  $\phi_s = -2 \beta_s$  and obtains 90% CL interval  $-0.03 < \beta_s < 0.60$  rad.
- <sup>23</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>24</sup> Reports  $\phi_s$  which equals to  $-2\beta_s$ .
- <sup>25</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.

**$|\lambda| (B_s^0 \rightarrow J/\psi(1S)\phi)$**

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.964 \pm 0.019 \pm 0.007</math></b>	AAIJ	15I	LHCB $pp$ at 7, 8 TeV

**$|\lambda|$**

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>1.001 \pm 0.017</math> OUR AVERAGE</b>			
$0.994 \pm 0.018 \pm 0.006$	1 AAIJ	17V	LHCB $pp$ at 7, 8 TeV
$1.045^{+0.069}_{-0.050} \pm 0.007$	2 AAIJ	16AK	LHCB $pp$ at 7, 8 TeV
$1.04 \pm 0.07 \pm 0.03$	3 AAIJ	14AE	LHCB $pp$ at 7, 8 TeV
$0.91^{+0.18}_{-0.15} \pm 0.02$	4 AAIJ	14AY	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi K^+ K^-$  in the region  $m(KK) > 1.05$  GeV.

<sup>2</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow \psi(2S)\phi$  decays.

<sup>3</sup> Measured in  $B_s^0 \rightarrow \phi\phi$  decays.

<sup>4</sup> Measured in  $B_s^0 \rightarrow D_s^+ D_s^-$  decays.

**A, CP violation parameter**

$$A = -2 \operatorname{Re}(\lambda) / (1 + |\lambda|^2)$$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.49^{+0.77}_{-0.65} \pm 0.06</math></b>	1 AAIJ	15AL	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Measured in  $B_s^0 \rightarrow J/\psi K_S^0$  decays.

**C, CP violation parameter**

$$C = (1 - |\lambda|^2) / (1 + |\lambda|^2)$$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>-0.28 \pm 0.41 \pm 0.08</math></b>	1 AAIJ	15AL	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Measured in  $B_s^0 \rightarrow J/\psi K_S^0$  decays.

**S, CP violation parameter**

$$S = -2 \operatorname{Im}(\lambda) / (1 + |\lambda|^2)$$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>-0.08 \pm 0.40 \pm 0.08</math></b>	1 AAIJ	15AL	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Measured in  $B_s^0 \rightarrow J/\psi K_S^0$  decays.

**$A_{CP}^L(B_s \rightarrow J/\psi \bar{K}^*(892)^0)$**

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>-0.048 \pm 0.057 \pm 0.020</math></b>	AAIJ	15AV	LHCB $pp$ at 7, 8 TeV

**$A_{CP}^{\parallel}(B_s \rightarrow J/\psi \bar{K}^*(892)^0)$**

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.171 \pm 0.152 \pm 0.028</math></b>	AAIJ	15AV	LHCB $pp$ at 7, 8 TeV

**$A_{CP}^{\perp}(B_s \rightarrow J/\psi \bar{K}^*(892)^0)$**

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>-0.049 \pm 0.096 \pm 0.025</math></b>	AAIJ	15AV	LHCB $pp$ at 7, 8 TeV

### $A_{CP}(B_s \rightarrow \pi^+ K^-)$

$A_{CP}$  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>0.26 ± 0.04 OUR AVERAGE</b>			
0.22 ± 0.07 ± 0.02	AALTONEN	14P CDF	$p\bar{p}$ at 1.96 TeV
0.27 ± 0.04 ± 0.01	AAIJ	13AX LHCb	$pp$ at 7 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.27 ± 0.08 ± 0.02	AAIJ	12V LHCb	Repl. by AAIJ 13AX
0.39 ± 0.15 ± 0.08	AALTONEN	11N CDF	Repl. by AALTONEN 14P

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b>-0.04 ± 0.07 ± 0.02</b>	AAIJ	14BN LHCb	$pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.04 ± 0.16 ± 0.01	AAIJ	13L LHCb	Repl. by AAIJ 14BN

### $A_{CP}(B_s^0 \rightarrow [\pi^+ K^-]_D K^*(892)^0)$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>-0.01 ± 0.03 ± 0.02</b>	AAIJ	14BN LHCb	$pp$ at 7, 8 TeV

### $A_{CP}(B_s^0 \rightarrow [\pi^+ \pi^-]_D K^*(892)^0)$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.06 ± 0.13 ± 0.02</b>	AAIJ	14BN LHCb	$pp$ at 7, 8 TeV

### $A^\Delta(B_s \rightarrow \phi \gamma)$

$A^\Delta(B_s \rightarrow \phi \gamma)$  is the multiplicative coefficient of the  $\sinh(\Delta\Gamma t/2)$  term in the  $B_s \rightarrow \phi \gamma$  decay rate time dependence.

VALUE	DOCUMENT ID	TECN	COMMENT
<b>-0.98<sup>+0.46+0.23</sup><sub>-0.52-0.20</sub></b>	<sup>1</sup> AAIJ	17B LHCb	$pp$ at 7, 8 TeV

<sup>1</sup> Measured in time dependent analysis without initial flavor tagging.

## CPT VIOLATION PARAMETERS

In the  $B_s^0$  mixing, propagating mass eigenstates can be written as

$$\begin{aligned} |B_{sL}\rangle &\propto p \sqrt{1-\xi} |B_s^0\rangle + q \sqrt{1+\xi} |\bar{B}_s^0\rangle \\ |B_{sH}\rangle &\propto p \sqrt{1+\xi} |B_s^0\rangle - q \sqrt{1-\xi} |\bar{B}_s^0\rangle \end{aligned}$$

where parameter  $\xi$  controls  $CPT$  violation. If  $\xi$  is zero, then  $CPT$  is conserved. The parameter  $\xi$  can be written as

$$\xi = \frac{2(M_{11}-M_{22})-i(\Gamma_{11}-\Gamma_{22})}{-2\Delta m_s+i\Delta\Gamma_s} \approx \frac{-2\beta^\mu \Delta a_\mu}{2\Delta m_s-i\Delta\Gamma_s},$$

where  $M_{ii}$ ,  $\Gamma_{ii}$ ,  $\Delta m_S$ , and  $\Delta\Gamma_S$  are parameters of Hamiltonian governing  $B_S$  oscillations,  $\beta^\mu$  is the  $B_S^0$  meson velocity and  $\Delta a_\mu$  characterizes Lorentz-invariance violation.

### $\Delta a_\perp$

VALUE ( $10^{-12}$ GeV)	CL%	DOCUMENT ID	TECN	COMMENT
$-0.47 \pm 0.39 \pm 0.08$		<sup>1</sup> AAIJ	16E	LHCB $pp$ at 7, 8 TeV
$< 1.2$	95	<sup>2</sup> ABAZOV	15L	D0 $p\bar{p}$ at 1.96 TeV

<sup>1</sup> Uses  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays.  
<sup>2</sup> Measured in semileptonic  $B_S^0 \rightarrow D_S^- \mu^+ X$  decays. Also extracts limit on time and longitudinal components ( $-0.8 < \Delta a_T - 0.396 \Delta a_Z < 3.9$ )  $10^{-13}$  GeV.

### $\Delta a_\parallel$

VALUE ( $10^{-14}$ GeV)	DOCUMENT ID	TECN	COMMENT
$-0.89 \pm 1.41 \pm 0.36$	<sup>1</sup> AAIJ	16E	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Uses  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays.

### $\Delta a_X$

VALUE ( $10^{-14}$ GeV)	DOCUMENT ID	TECN	COMMENT
$+1.01 \pm 2.08 \pm 0.71$	<sup>1</sup> AAIJ	16E	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Uses  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays.

### $\Delta a_Y$

VALUE ( $10^{-14}$ GeV)	DOCUMENT ID	TECN	COMMENT
$-3.83 \pm 2.09 \pm 0.71$	<sup>1</sup> AAIJ	16E	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Uses  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays.

### Re( $\xi$ )

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.022 \pm 0.033 \pm 0.003$	<sup>1</sup> AAIJ	16E	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Uses  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays.

### Im( $\xi$ )

VALUE	DOCUMENT ID	TECN	COMMENT
$0.004 \pm 0.011 \pm 0.002$	<sup>1</sup> AAIJ	16E	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> Uses  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays.

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

### $B(B_S \rightarrow \phi \ell^+ \ell^-)$ ( $0.1 < q^2 < 2.0 \text{ GeV}^2/c^4$ )

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.14 ± 0.16 OUR AVERAGE</b>			
1.11 $^{+0.14}_{-0.13}$ ± 0.09	<sup>1</sup> AAIJ	15AQ	LHCB $pp$ at 7, 8 TeV
2.78 ± 0.95 ± 0.89	AALTONEN	11AI	CDF $p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.897 $^{+0.207}_{-0.186}$ ± 0.097	<sup>1</sup> AAIJ	13X	LHCB Repl. by AAIJ 15AQ

<sup>1</sup> Measured in  $B_S^0 \rightarrow \phi \mu^+ \mu^-$  decays.

**$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $2.0 < q^2 < 5.0 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.77 \pm 0.12 \pm 0.06</math></b>	<sup>1</sup> AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.529^{+0.182}_{-0.159} \pm 0.057$	<sup>1,2</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
$0.58 \pm 0.55 \pm 0.19$	<sup>2</sup> AALTONEN	11AI CDF	$p\bar{p}$ at 1.96 TeV
<sup>1</sup> Measured in $B_s^0 \rightarrow \phi \mu^+ \mu^-$ decays.			
<sup>2</sup> Measured in $2 < q^2 < 4.3 \text{ GeV}^2/c^4$ .			

 **$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $5.0 < q^2 < 8.0 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.96 \pm 0.13 \pm 0.08</math></b>	<sup>1</sup> AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.38^{+0.25}_{-0.23} \pm 0.14$	<sup>1,2</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
$1.34 \pm 0.83 \pm 0.43$	<sup>2</sup> AALTONEN	11AI CDF	$p\bar{p}$ at 1.96 TeV
<sup>1</sup> Measured in $B_s^0 \rightarrow \phi \mu^+ \mu^-$ decays.			
<sup>2</sup> Measured in $4.3 < q^2 < 8.68 \text{ GeV}^2/c^4$ .			

 **$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $11.0 < q^2 < 12.5 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.71 \pm 0.10 \pm 0.06</math></b>	<sup>1</sup> AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.18^{+0.22}_{-0.21} \pm 0.14$	<sup>1,2</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
$2.98 \pm 0.95 \pm 0.95$	<sup>2</sup> AALTONEN	11AI CDF	$p\bar{p}$ at 1.96 TeV
<sup>1</sup> Measured in $B_s^0 \rightarrow \phi \mu^+ \mu^-$ decays.			
<sup>2</sup> Measured in $10.9 < q^2 < 12.86 \text{ GeV}^2/c^4$ .			

 **$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $15.0 < q^2 < 17.0 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.90 \pm 0.11 \pm 0.07</math></b>	<sup>1</sup> AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.760^{+0.189}_{-0.169} \pm 0.087$	<sup>1,2</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
$1.86 \pm 0.66 \pm 0.59$	<sup>2</sup> AALTONEN	11AI CDF	$p\bar{p}$ at 1.96 TeV
<sup>1</sup> Measured in $B_s^0 \rightarrow \phi \mu^+ \mu^-$ decays.			
<sup>2</sup> Measured in $14.18 < q^2 < 16 \text{ GeV}^2/c^4$ .			

 **$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $17.0 < q^2 < 19.0 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.79 \pm 0.11 \pm 0.07</math></b>	<sup>1</sup> AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.06^{+0.23}_{-0.21} \pm 0.12$	<sup>1,2</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
$2.32 \pm 0.76 \pm 0.74$	<sup>2</sup> AALTONEN	11AI CDF	$p\bar{p}$ at 1.96 TeV
<sup>1</sup> Measured in $B_s^0 \rightarrow \phi \mu^+ \mu^-$ decays.			
<sup>2</sup> Measured in $16 < q^2 < 19 \text{ GeV}^2/c^4$ .			



### $B(B_s \rightarrow \phi \ell^+ \ell^-) (1.0 < q^2 < 6.0 \text{ GeV}^2/c^4)$

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.28 ± 0.18 OUR AVERAGE</b>			
1.29 ± 0.16 ± 0.10	<sup>1</sup> AAIJ	15AQ LHCb	$pp$ at 7, 8 TeV
1.14 ± 0.79 ± 0.36	AALTONEN	11AI CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.14 <sup>+0.25</sup> <sub>-0.23</sub> ± 0.13	<sup>1</sup> AAIJ	13X LHCb	Repl. by AAIJ 15AQ

<sup>1</sup> Measured in  $B_s^0 \rightarrow \phi \mu^+ \mu^-$  decays.

### $B(B_s \rightarrow \phi \ell^+ \ell^-) (0.0 < q^2 < 4.3 \text{ GeV}^2/c^4)$

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

## PRODUCTION ASYMMETRIES

### $A_P(B_s^0)$

$$A_P(B_s^0) = [\sigma(\bar{B}_s^0) - \sigma(B_s^0)] / [\sigma(\bar{B}_s^0) + \sigma(B_s^0)]$$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.2 ± 1.6 OUR AVERAGE</b>			
-0.65 ± 2.88 ± 0.59	<sup>1</sup> AAIJ	17BF LHCb	$pp$ at 7 TeV
1.98 ± 1.90 ± 0.59	<sup>1</sup> AAIJ	17BF LHCb	$pp$ at 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.09 ± 2.61 ± 0.66	<sup>2</sup> AAIJ	14BP LHCb	Repl. by AAIJ 17BF, $pp$ at 7 TeV

<sup>1</sup> Based on time-dependent analysis of  $B_s^0 \rightarrow D_s^- \pi^+$  in kinematic range  $2 < p_T < 30$  GeV/c and  $2.1 < \eta < 4.5$ .

<sup>2</sup> Based on time-dependent analysis of  $B_s^0 \rightarrow D_s^- \pi^+$  in kinematic range  $4 < p_T < 30$  GeV/c and  $2.5 < \eta < 4.5$ .

## $B_s^0$ REFERENCES

AAIJ	17A	PR D95 012006	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17AI	PRL 118 191801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17AJ	PRL 118 251802	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17AL	PRL 119 041802	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17AN	PRL 119 101801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17B	PRL 118 021801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17BA	JHEP 1705 158	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17BD	PR D96 051103	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17BF	PL B774 139	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17BJ	PRL 119 232001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17BP	JHEP 1711 027	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17G	PRL 118 081801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17N	JHEP 1703 001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17U	JHEP 1707 021	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17V	JHEP 1708 037	R. Aaij <i>et al.</i>	(LHCb Collab.)
AABOUD	16L	EPJ C76 513	M. Aaboud <i>et al.</i>	(ATLAS Collab.)
AAD	16AP	JHEP 1608 147	G. Aad <i>et al.</i>	(ATLAS Collab.)
AAIJ	16	JHEP 1601 012	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	16AK	PL B762 253	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	16AL	PL B762 484	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	16C	PRL 116 161802	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	16E	PRL 116 241601	R. Aaij <i>et al.</i>	(LHCb Collab.)

AAIJ	16G	PRL 117 061803	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	16P	PR D93 092008	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	16U	JHEP 1603 040	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	16C	PR D94 012001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
KHACHATRY...	16Q	PL B756 84	V. Khachatryan <i>et al.</i>	(CMS Collab.)
KHACHATRY...	16S	PL B757 97	V. Khachatryan <i>et al.</i>	(CMS Collab.)
PAL	16	PRL 116 161801	B. Pal <i>et al.</i>	(BELLE Collab.)
AAIJ	15AC	JHEP 1505 019	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15AD	JHEP 1506 130	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15AF	JHEP 1507 166	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15AG	JHEP 1508 005	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15AL	JHEP 1506 131	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15AQ	JHEP 1509 179	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15AS	JHEP 1510 053	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15AV	JHEP 1511 082	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15BB	PR D92 112002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15D	JHEP 1501 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15I	PRL 114 041801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15K	PL B741 1	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15O	PRL 115 051801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15S	PL B743 46	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15U	PL B747 484	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	15A	PRL 114 062001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	15L	PRL 115 161601	V.M. Abazov <i>et al.</i>	(D0 Collab.)
DUTTA	15	PR D91 011101	D. Dutta <i>et al.</i>	(BELLE Collab.)
KHACHATRY...	15BE	NAT 522 68	V. Khachatryan <i>et al.</i>	(CMS and LHCb Collab.)
OSWALD	15	PR D92 072013	C. Oswald <i>et al.</i>	(BELLE Collab.)
AAD	14U	PR D90 052007	G. Aad <i>et al.</i>	(ATLAS Collab.)
AAIJ	14AA	PRL 112 202001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14AE	PR D90 052011	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14AX	PRL 113 172001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14AY	PRL 113 211801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BF	JHEP 1411 060	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BH	PR D90 072003	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BM	NJP 16 123001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BN	PR D90 112002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BP	PL B739 218	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BR	PR D89 092006	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14D	PL B728 607	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14E	JHEP 1404 114	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14F	PRL 112 111802	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14L	JHEP 1407 140	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14R	PL B736 446	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14S	PL B736 186	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14Y	PRL 112 091802	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14P	PRL 113 242001	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	14	PR D89 012002	V.M. Abazov <i>et al.</i>	(D0 Collab.)
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
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	13AA	NP B871 403	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AB	NP B873 275	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AC	NP B874 663	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AL	PR D87 071101	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AN	PR D87 072004	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AP	PR D87 092007	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AQ	PR D87 112009	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AR	PR D87 112010	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AW	PRL 110 211801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AX	PRL 110 221601	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AY	PRL 110 241802	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13B	PRL 110 021801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BA	PRL 111 101805	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BI	NJP 15 053021	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BM	PRL 111 141801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BO	JHEP 1310 183	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BP	JHEP 1310 143	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BQ	JHEP 1310 005	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BW	JHEP 1311 092	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BX	PL B727 403	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13CF	EPJ C73 2655	R. Aaij <i>et al.</i>	(LHCb Collab.)

AAIJ	13L	JHEP 1303 067	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13X	JHEP 1307 084	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13Z	JHEP 1309 006	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	13F	PR D87 072003	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	13	PRL 110 011801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABAZOV	13C	PR D87 072006	V.M. Abazov <i>et al.</i>	(D0 Collab.)
CHATRCHYAN	13AW	PRL 111 101804	S. Chatrchyan <i>et al.</i>	(CMS Collab.)
ESEN	13	PR D87 031101	S. Esen <i>et al.</i>	(BELLE Collab.)
OSWALD	13	PR D87 072008	C. Oswald <i>et al.</i>	(BELLE Collab.)
Also		PR D90 119901 (errat.)	C. Oswald <i>et al.</i>	(BELLE Collab.)
SOLOVIEVA	13	PL B726 206	E. Solovieva <i>et al.</i>	(BELLE Collab.)
THORNE	13	PR D88 114006	F. Thorne <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.)
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG 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	(LHCb Collab.)
AAIJ	11E	PR D84 092001	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D85 039904 (errat.)	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 (errat.)	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	PRL 105 081801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
Also		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	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	07Y	PRL 99 241801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABULENCIA	07C	PRL 98 061802	A. Abulencia <i>et al.</i>	(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	05W	PRL 95 171801	V.M. Abazov <i>et al.</i>	(D0 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.)
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	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>	(PDG Collab.)
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	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>	(PDG Collab.)
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.)

---