



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

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

### $B_s^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>5366.92 ± 0.10 OUR FIT</b>				
<b>5366.91 ± 0.11 OUR AVERAGE</b>				
5366.98 ± 0.07 ± 0.13		<sup>1</sup> AAIJ	21C LHCb	$pp$ at 7, 8, 13 TeV
5366.85 ± 0.19 ± 0.13		<sup>2</sup> AAIJ	19U LHCb	$pp$ at 7, 8, 13 TeV
5366.83 ± 0.25 ± 0.27		<sup>3</sup> AAIJ	18AC LHCb	$pp$ at 7, 8, 13 TeV
5367.08 ± 0.38 ± 0.15	128	<sup>4</sup> AAIJ	16U LHCb	$pp$ at 7, 8 TeV
5366.90 ± 0.28 ± 0.23		<sup>5</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>6</sup> ACOSTA	06 CDF	$p\bar{p}$ at 1.96 TeV
5369.9 ± 2.3 ± 1.3	32	<sup>7</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>7</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>8</sup> AKERS	94J OPAL	$e^+e^- \rightarrow Z$
5383.3 ± 4.5 ± 5.0	14	ABE	93F CDF	Repl. by ABE 96B
<sup>1</sup> Uses $B_s^0 \rightarrow J/\psi \pi^+ \pi^- K^+ K^-$ decays.				
<sup>2</sup> Uses $B_s^0 \rightarrow J/\psi p\bar{p}$ decays.				
<sup>3</sup> Uses $B_s \rightarrow \chi_{c1} K^+ K^-$ mode.				
<sup>4</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>5</sup> Uses $B_s^0 \rightarrow J/\psi \phi$ fully reconstructed decays.				
<sup>6</sup> Uses exclusively reconstructed final states containing a $J/\psi \rightarrow \mu^+ \mu^-$ decays.				
<sup>7</sup> From the decay $B_s \rightarrow J/\psi(1S)\phi$ .				
<sup>8</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 ± 0.14 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-FRANZINI 90 CSB2  $e^+e^- \rightarrow \gamma(5S)$

<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, <https://hflav.web.cern.ch/>).

The mean  $B_s^0$  lifetime is defined and computed as  $1/\Gamma_{B_s^0}$ , where  $\Gamma_{B_s^0}$  is the average decay width of the  $B_s^0$  mass eigenstates.

VALUE ( $10^{-12}$ s)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.521±0.005 OUR EVALUATION</b>				
1.518±0.041±0.027		<sup>1</sup> AALTONEN	11AP CDF	$p\bar{p}$ at 1.96 TeV
1.398±0.044 <sup>+0.028</sup> <sub>-0.025</sub>		<sup>2</sup> ABAZOV	06V D0	$p\bar{p}$ at 1.96 TeV
1.42 <sup>+0.14</sup> <sub>-0.13</sub> ±0.03		<sup>3</sup> ABREU	00Y DLPH	$e^+e^- \rightarrow Z$
1.53 <sup>+0.16</sup> <sub>-0.15</sub> ±0.07		<sup>4</sup> ABREU,P	00G DLPH	$e^+e^- \rightarrow Z$
1.36 ±0.09 <sup>+0.06</sup> <sub>-0.05</sub>		<sup>5</sup> ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
1.72 <sup>+0.20</sup> <sub>-0.19</sub> <sup>+0.18</sup> <sub>-0.17</sub>		<sup>6</sup> ACKERSTAFF	98F OPAL	$e^+e^- \rightarrow Z$
1.50 <sup>+0.16</sup> <sub>-0.15</sub> ±0.04		<sup>5</sup> ACKERSTAFF	98G OPAL	$e^+e^- \rightarrow Z$
1.47 ±0.14 ±0.08		<sup>4</sup> BARATE	98C ALEP	$e^+e^- \rightarrow Z$
1.51 ±0.11		<sup>7</sup> BARATE	98C ALEP	$e^+e^- \rightarrow Z$
1.56 <sup>+0.29</sup> <sub>-0.26</sub> <sup>+0.08</sup> <sub>-0.07</sub>		<sup>5</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.65 <sup>+0.34</sup> <sub>-0.31</sub> ±0.12		<sup>4</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.76 ±0.20 <sup>+0.15</sup> <sub>-0.10</sub>		<sup>8</sup> ABREU	96F DLPH	Repl. by ABREU 00Y
1.60 ±0.26 <sup>+0.13</sup> <sub>-0.15</sub>		<sup>9</sup> ABREU	96F DLPH	Repl. by ABREU,P 00G

1.67 ±0.14		<sup>10</sup> ABREU	96F	DLPH	$e^+e^- \rightarrow Z$
1.61 $\begin{smallmatrix} +0.30 \\ -0.29 \end{smallmatrix}$ $\begin{smallmatrix} +0.18 \\ -0.16 \end{smallmatrix}$	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 ACKER-STAFF 98G
1.59 $\begin{smallmatrix} +0.17 \\ -0.15 \end{smallmatrix}$ ±0.03	134	<sup>5</sup> BUSKULIC	95O	ALEP	Sup. by BUSKULIC 96M
0.96 ±0.37	41	<sup>12</sup> ABREU	94E	DLPH	Sup. by ABREU 96F
1.92 $\begin{smallmatrix} +0.45 \\ -0.35 \end{smallmatrix}$ ±0.04	31	<sup>5</sup> BUSKULIC	94C	ALEP	Sup. by BUSKULIC 95O
1.13 $\begin{smallmatrix} +0.35 \\ -0.26 \end{smallmatrix}$ ±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.

## $\Gamma_{B_s^0}$

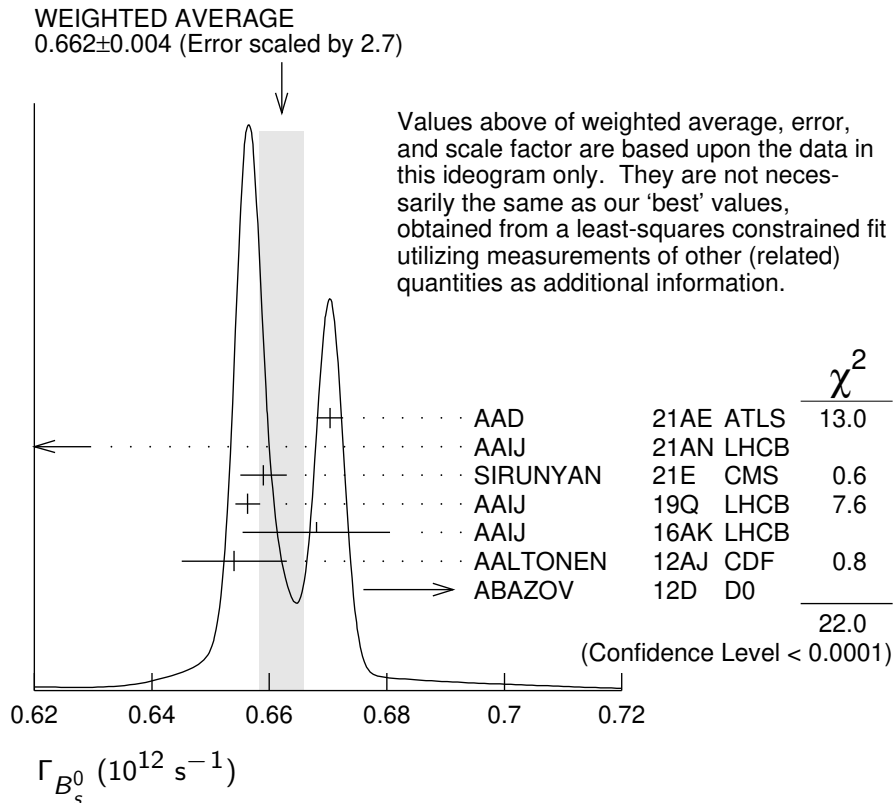
"OUR EVALUATION" is an average performed by the Heavy Flavor Averaging Group (HFLAV, <https://hflav.web.cern.ch/>) as described in our "Review on  $B$ - $\bar{B}$  Mixing" in the  $B^0$  section of these Listings. It includes the measurements of  $\Gamma_{B_s^0}$  and  $\Delta\Gamma_{B_s^0}$  listed 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>0.6573 ± 0.0023 OUR EVALUATION</b>	Error includes scale factor of 2.6.		
<b>0.662 ± 0.004 OUR AVERAGE</b>	Error includes scale factor of 2.7. See the ideogram below.		
0.6703 ± 0.0014 ± 0.0018	<sup>1</sup> AAD	21AE ATLS	$pp$ at 7, 8, 13 TeV
0.608 ± 0.018 ± 0.012	<sup>2</sup> AAIJ	21AN LHCb	$pp$ at 7, 8 TeV
0.6590 ± 0.0032 ± 0.0023	<sup>1</sup> SIRUNYAN	21E CMS	$pp$ at 8, 13 TeV

0.6563 ± 0.0021	<sup>3</sup> AAIJ	19Q LHCb	$pp$ at 7, 8, 13 TeV
0.668 ± 0.011 ± 0.006	<sup>4</sup> AAIJ	16AK LHCb	$pp$ at 7, 8 TeV
0.654 ± 0.008 ± 0.004	<sup>1</sup> AALTONEN	12AJ CDF	$p\bar{p}$ at 1.96 TeV
0.693 <sup>+0.018</sup> <sub>-0.017</sub>	<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. • • •

0.6531 ± 0.0042 ± 0.0026	<sup>1</sup> SIRUNYAN	21E CMS	$pp$ at 13 TeV
0.650 ± 0.006 ± 0.004	<sup>3</sup> AAIJ	17V LHCb	Repl. by AAIJ 19Q
0.675 ± 0.003 ± 0.003	<sup>1</sup> AAD	16AP ATLS	Repl. by AAD 21AE
0.6704 ± 0.0043 ± 0.0055	<sup>1</sup> KHACHATRY...	16S CMS	$pp$ at 8 TeV
0.6603 ± 0.0027 ± 0.0015	<sup>5</sup> AAIJ	15I LHCb	Repl. by AAIJ 19Q
0.677 ± 0.007 ± 0.004	<sup>1</sup> AAD	14U ATLS	Repl. by AAD 16AP
0.661 ± 0.004 ± 0.006	<sup>6</sup> AAIJ	13AR LHCb	Repl. by AAIJ 15I
0.677 ± 0.007 ± 0.004	<sup>1</sup> AAD	12CV ATLS	Repl. by AAD 14U
0.657 ± 0.009 ± 0.008	<sup>1</sup> AAIJ	12D LHCb	Repl. by AAIJ 13AR
0.654 ± 0.011 ± 0.005	<sup>1,7</sup> AALTONEN	12D CDF	Repl. by AALTONEN 12AJ
0.672 ± 0.027 ± 0.013	<sup>1</sup> ABAZOV	09E D0	Repl. by ABAZOV 08AM
0.658 ± 0.017 ± 0.009	<sup>1,8</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
0.658 ± 0.022 ± 0.004	<sup>1</sup> ABAZOV	08AMD0	Repl. by ABAZOV 12D
0.658 ± 0.035 <sup>+0.0130</sup> <sub>-0.004</sub>	<sup>1,8</sup> ABAZOV	07 D0	Repl. by ABAZOV 09E
0.714 <sup>+0.007</sup> <sub>-0.008</sub> ± 0.010	<sup>1,8</sup> ACOSTA	05 CDF	Repl. by AALTONEN 08J



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

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

- <sup>3</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>4</sup> Measured using a time-dependent angular analysis of  $B_S^0 \rightarrow \psi(2S)\phi$  decays.
- <sup>5</sup> Measured using a time-dependent angular analysis of  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays.
- <sup>6</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>7</sup> Assuming CPV phase  $\phi_S = -0.04$ .
- <sup>8</sup> Assuming CPV phase  $\phi_S = 0$ .

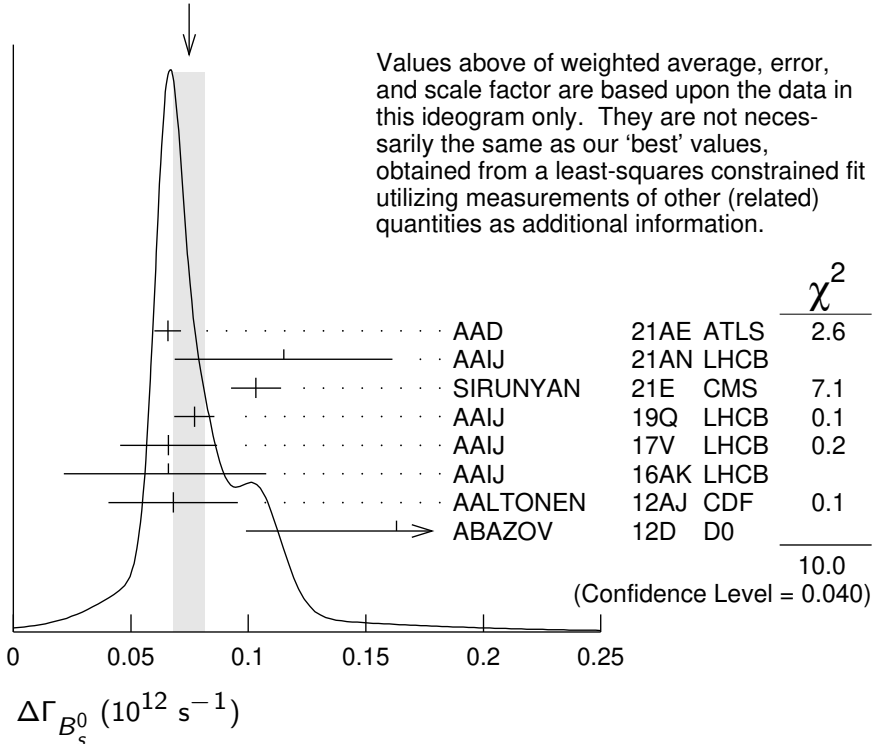
### $\Delta\Gamma_{B_S^0}$

“OUR EVALUATION” is an average performed by the Heavy Flavor Averaging Group (HFLAV, <https://hflav.web.cern.ch/>) 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>0.083 ± 0.005 OUR EVALUATION</b>	Error includes scale factor of 1.7.		
<b>0.075 ± 0.007 OUR AVERAGE</b>	Error includes scale factor of 1.6. See the ideogram below.		
0.0657 ± 0.0043 ± 0.0037	<sup>1</sup> AAD	21AE ATLS	$pp$ at 7, 8, 13 TeV
0.115 ± 0.045 ± 0.011	<sup>2</sup> AAIJ	21AN LHCb	$pp$ at 7, 8 TeV
0.1032 ± 0.0095 ± 0.0048	<sup>1</sup> SIRUNYAN	21E CMS	$pp$ at 8, 13 TeV
0.077 ± 0.008 ± 0.003	<sup>3</sup> AAIJ	19Q LHCb	$pp$ at 13 TeV
0.066 ± 0.018 ± 0.010	<sup>4</sup> AAIJ	17V LHCb	$pp$ at 7, 8 TeV
0.066 $\begin{smallmatrix} +0.041 \\ -0.044 \end{smallmatrix}$ ± 0.007	<sup>5</sup> AAIJ	16AK LHCb	$pp$ at 7, 8 TeV
0.068 ± 0.026 ± 0.009	<sup>1</sup> AALTONEN	12AJ CDF	$p\bar{p}$ at 1.96 TeV
0.163 $\begin{smallmatrix} +0.065 \\ -0.064 \end{smallmatrix}$	<sup>1,6</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.114 ± 0.014 ± 0.007	<sup>1</sup> SIRUNYAN	21E CMS	$pp$ at 13 TeV
0.085 ± 0.011 ± 0.007	<sup>1</sup> AAD	16AP ATLS	Repl. by AAD 21AE
0.095 ± 0.013 ± 0.007	<sup>1</sup> KHACHATRY...	16S CMS	$pp$ at 8 TeV
0.0805 ± 0.0091 ± 0.0032	<sup>3</sup> AAIJ	15I LHCb	Repl. by AAIJ 19Q
0.053 ± 0.021 ± 0.010	<sup>1</sup> AAD	14U ATLS	Repl. by AAD 16AP
0.106 ± 0.011 ± 0.007	<sup>7</sup> AAIJ	13AR LHCb	Repl. by AAIJ 15I
0.053 ± 0.021 ± 0.010	<sup>1</sup> AAD	12CV ATLS	Repl. by AAD 14U
0.123 ± 0.029 ± 0.011	<sup>1</sup> AAIJ	12D LHCb	Repl. by AAIJ 13AR
0.075 ± 0.035 ± 0.006	<sup>8</sup> AALTONEN	12D CDF	Repl. by AALTONEN 12AJ
0.085 $\begin{smallmatrix} +0.072 \\ -0.078 \end{smallmatrix}$ ± 0.001	<sup>9</sup> ABAZOV	09E D0	Repl. by ABAZOV 08AM
0.076 $\begin{smallmatrix} +0.059 \\ -0.063 \end{smallmatrix}$ ± 0.006	<sup>10</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
0.19 ± 0.07 $\begin{smallmatrix} +0.02 \\ -0.01 \end{smallmatrix}$	<sup>1,11</sup> ABAZOV	08AMD0	Repl. by ABAZOV 12D

0.12	$+0.08$ $-0.10$	$\pm 0.02$	10,12	ABAZOV	07	D0	Repl. by ABAZOV 07N
0.13	$\pm 0.09$		13	ABAZOV	07N	D0	Repl. by ABAZOV 09E
0.47	$+0.19$ $-0.24$	$\pm 0.01$	10	ACOSTA	05	CDF	Repl. by AALTONEN 08J

WEIGHTED AVERAGE  
 $0.075 \pm 0.007$  (Error scaled by 1.6)



- <sup>1</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays.
- <sup>2</sup> Measured using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi \phi$  decays with  $J/\psi \rightarrow e^+ e^-$ .
- <sup>3</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi K^+ K^-$  decays.
- <sup>4</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>5</sup> Measured using time-dependent angular analysis of  $B_s^0 \rightarrow \psi(2S) \phi$  decays.
- <sup>6</sup> The error includes both statistical and systematic uncertainties.
- <sup>7</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  $\Delta\Gamma_s = 0.100 \pm 0.016 \pm 0.003$  ps<sup>-1</sup> from a fit to  $B_s^0 \rightarrow J/\psi K^+ K^-$  decays.
- <sup>8</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>9</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>10</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>11</sup> Obtains 90% CL interval  $-0.06 < \Delta\Gamma_s < 0.30$ .
- <sup>12</sup> ABAZOV 07 reports  $0.17 \pm 0.09 \pm 0.02$  with  $CP$ -violating phase  $\phi_s$  as a free parameter.

<sup>13</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, <https://hflav.web.cern.ch/>). 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>0.126 ± 0.007 OUR EVALUATION</b>				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.090 ± 0.009 ± 0.023		1 ESEN	13 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
		2 AAIJ	12D LHCB	$p\bar{p}$ at 7 TeV
		3 AALTONEN	12D CDF	$p\bar{p}$ at 1.96 TeV
		4 ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV
0.147 <sup>+0.036</sup> <sub>-0.030</sub> ± 0.042 <sub>-0.041</sub>		1 ESEN	10 BELL	$e^+e^- \rightarrow \Upsilon(5S)$
0.072 ± 0.021 ± 0.022		5 ABAZOV	09I D0	$p\bar{p}$ at 1.96 TeV
>0.012	95	5 AALTONEN	08F CDF	$p\bar{p}$ at 1.96 TeV
0.116 <sup>+0.09</sup> <sub>-0.10</sub> ± 0.010		6 AALTONEN	08J CDF	Repl. by AALTONEN 12D
0.079 <sup>+0.038</sup> <sub>-0.035</sub> ± 0.031 <sub>-0.030</sub>		5 ABAZOV	07Y D0	Repl. by ABAZOV 09I
0.24 <sup>+0.28</sup> <sub>-0.38</sub> ± 0.03 <sub>-0.04</sub>		6,7 ABAZOV	05W D0	Repl. by ABAZOV 08AM
0.65 <sup>+0.25</sup> <sub>-0.33</sub> ± 0.01		6 ACOSTA	05 CDF	Repl. by AALTONEN 08J
<0.46	95	8 ABREU	00Y DLPH	$e^+e^- \rightarrow Z$
<0.69	95	9 ABREU,P	00G DLPH	$e^+e^- \rightarrow Z$
0.25 <sup>+0.21</sup> <sub>-0.14</sub>		10 BARATE	00K ALEP	$e^+e^- \rightarrow Z$
<0.83	95	11 ABE	99D CDF	$p\bar{p}$ at 1.8 TeV
<0.67	95	12 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  $2 \text{B}(B_s^0 \rightarrow D_s^{(*)} D_s^{(*)}) \simeq \Delta\Gamma_s^{CP} / \Gamma_s$ .

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

<sup>7</sup> Uses  $|A_0|^2 - |A_{||}|^2 = 0.355 \pm 0.066$  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, <https://hflav.web.cern.ch/>). 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>1.624 ± 0.009 OUR EVALUATION</b>			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2.07 ± 0.29 ± 0.03	<sup>1</sup> AAIJ	22 LHCb	$p\bar{p}$ at 7, 8, 13 TeV
1.70 $^{+0.60}_{-0.43}$ ± 0.09	<sup>1</sup> SIRUNYAN	20AG CMS	$p\bar{p}$ at 7, 8, 13 TeV
1.677 ± 0.034 ± 0.011	<sup>2</sup> SIRUNYAN	18BY CMS	$p\bar{p}$ at 8 TeV
2.04 ± 0.44 ± 0.05	<sup>1</sup> AAIJ	17AI LHCb	$p\bar{p}$ at 7, 8, 13 TeV
1.70 ± 0.14 ± 0.05	<sup>3</sup> ABAZOV	16C D0	$p\bar{p}$ at 1.96 TeV
1.75 ± 0.12 ± 0.07	<sup>4</sup> AAIJ	13AB LHCb	$p\bar{p}$ at 7 TeV
1.652 ± 0.024 ± 0.024	<sup>5</sup> AAIJ	13AR LHCb	$p\bar{p}$ at 7 TeV
1.700 ± 0.040 ± 0.026	<sup>6</sup> AAIJ	12AN LHCb	$p\bar{p}$ at 7 TeV
	<sup>7</sup> AALTONEN	12D CDF	$p\bar{p}$ at 1.96 TeV
1.70 $^{+0.12}_{-0.11}$ ± 0.03	<sup>6</sup> AALTONEN	11AB CDF	$p\bar{p}$ at 1.96 TeV
1.613 $^{+0.123}_{-0.113}$	<sup>8,9</sup> AALTONEN	08J CDF	Repl. by AALTONEN 12D
1.58 $^{+0.39}_{-0.42}$ $^{+0.01}_{-0.02}$	<sup>9</sup> ABAZOV	05W D0	Repl. by ABAZOV 08AM
2.07 $^{+0.58}_{-0.46}$ ± 0.03	<sup>9</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  $B_s^0 \rightarrow J/\psi \pi^+ \pi^-$  decays with  $0.9240 < m(\pi\pi) < 1.0204$  GeV, which is dominated by the  $f_0(980)$  resonance, making it a  $CP$ -odd state.

<sup>3</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>4</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>5</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>6</sup> Measured using a pure  $CP$ -odd final state  $J/\psi f_0(980)$ .

<sup>7</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>8</sup> Obtained from  $\Delta\Gamma_s$  and  $\Gamma_s$  fit with a correlation of 0.6.

<sup>9</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, <https://hflav.web.cern.ch/>). 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>1.431±0.007 OUR EVALUATION</b>			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1.452±0.014±0.0073	<sup>1</sup> AAIJ	23 LHCb	$pp$ at 7,8,13 TeV
1.40 ±0.02	<sup>2</sup> SIRUNYAN	18BY CMS	$pp$ at 8 TeV
1.479±0.034±0.011	<sup>1</sup> AAIJ	16AL LHCb	Repl. by AAIJ 23
1.379±0.026±0.017	<sup>3</sup> AAIJ	14F LHCb	$pp$ at 7, 8 TeV
1.407±0.016±0.007	<sup>4</sup> AAIJ	14R LHCb	$pp$ at 7 TeV
1.440±0.096±0.009	<sup>4</sup> AAIJ	12 LHCb	Repl. by AAIJ 14R
1.455±0.046±0.006	<sup>4</sup> AAIJ	12R LHCb	Repl. by AAIJ 14R
	<sup>5</sup> AALTONEN	12D CDF	$p\bar{p}$ at 1.96 TeV
1.437 <sup>+0.054</sup> <sub>-0.047</sub>	<sup>6,7</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>7</sup> ABAZOV	05W D0	Repl. by ABAZOV 08AM
1.05 <sup>+0.16</sup> <sub>-0.13</sub> ±0.02	<sup>7</sup> ACOSTA	05 CDF	Repl. by AALTONEN 08J
1.27 ±0.33 ±0.08	<sup>8</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 results in SIRUNYAN 18BY for the heavy  $B_s^0$  lifetime obtained from  $B_s^0 \rightarrow J/\psi\pi^+\pi^-$  decays and the average effective  $B_s^0 \rightarrow J/\psi\phi$  lifetime, and magnitude squared of the CP-odd amplitude  $|A_{\perp}|^2 = 0.250 \pm 0.006$ . The uncertainty includes all statistical and systematic contributions.

<sup>3</sup> Measured using  $B_s^0 \rightarrow D_s^- D_s^+$ . The effective lifetime is translated into a decay width of  $\Gamma_L = 0.725 \pm 0.014 \pm 0.009 \text{ ps}^{-1}$ .

<sup>4</sup> Measured using  $B_s^0 \rightarrow K^+ K^-$  decays. There may still be CPV in the decay.

<sup>5</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>6</sup> Obtained from  $\Delta\Gamma_s$  and  $\Gamma_s$  fit with a correlation of 0.6.

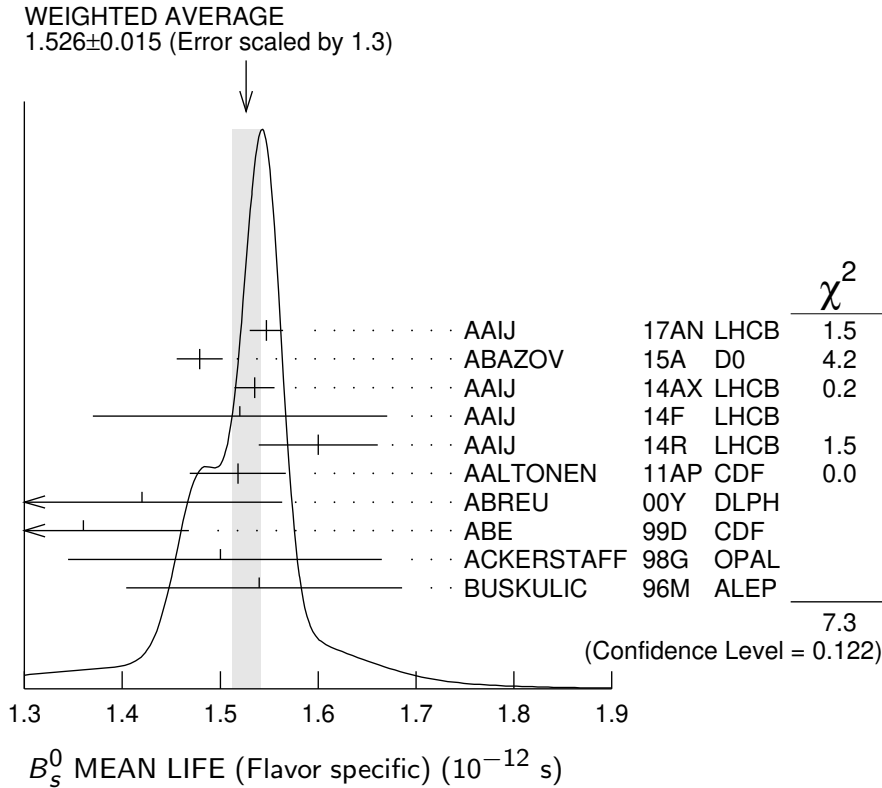
<sup>7</sup> Measured using the time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>8</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
<b>1.527±0.011 OUR EVALUATION</b>			
<b>1.526±0.015 OUR AVERAGE</b> 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>1.480 \pm 0.007</math></b>	<b>OUR EVALUATION</b>		
<b><math>1.480 \pm 0.007</math></b>	<b>OUR AVERAGE</b>		
$1.481 \pm 0.007 \pm 0.005$	<sup>1</sup> SIRUNYAN	18BY CMS	$pp$ at 8 TeV
$1.480 \pm 0.011 \pm 0.005$	<sup>1</sup> AAIJ	14E LHCB	$pp$ 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.			

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.980 \pm 0.006 \pm 0.003</math></b>	<sup>1</sup> SIRUNYAN	18BY CMS	$pp$ at 8 TeV
<sup>1</sup> Measured using $B_s^0 \rightarrow J/\psi\phi(1020)$ and $B^0 \rightarrow J/\psi K^*(892)^0$ decays.			

## $\Gamma_{B_s^0} - \Gamma_{B^0}$

VALUE ( $10^{12}$ s <sup>-1</sup> )	DOCUMENT ID	TECN	COMMENT
<b><math>-0.0041 \pm 0.0024 \pm 0.0015</math></b>	<sup>1</sup> AAIJ	19Q LHCB	$pp$ at 13 TeV
<sup>1</sup> Measured using time-dependent angular analysis of $B_s^0 \rightarrow J/\psi K^+ K^-$ decays.			

## $\Gamma_{B_s^0 H} - \Gamma_{B^0}$

VALUE ( $10^{12}$ s <sup>-1</sup> )	DOCUMENT ID	TECN	COMMENT
<b><math>-0.05 \pm 0.004 \pm 0.004</math></b>	<sup>1</sup> AAIJ	19AF LHCB	$pp$ at 7, 8, 13 TeV
<sup>1</sup> Measured in $B_s^0 \rightarrow J/\psi\pi^+\pi^-$ decays.			

## $B_s^0$ DECAY MODES

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

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

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

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level
$\Gamma_1$ $D_s^-$ anything	(62 ± 6 ) %	
$\Gamma_2$ $\ell \nu_\ell X$	( 9.6 ± 0.8 ) %	
$\Gamma_3$ $e^+ \nu X^-$	( 9.1 ± 0.8 ) %	
$\Gamma_4$ $\mu^+ \nu X^-$	(10.2 ± 1.0 ) %	
$\Gamma_5$ $D_s^- \ell^+ \nu_\ell$ anything	[a] ( 8.1 ± 1.3 ) %	
$\Gamma_6$ $D_s^{*-} \ell^+ \nu_\ell$ anything	( 5.4 ± 1.1 ) %	
$\Gamma_7$ $D_s^- \mu^+ \nu_\mu$	( 2.44 ± 0.23 ) %	
$\Gamma_8$ $D_s^{*-} \mu^+ \nu_\mu$	( 5.3 ± 0.5 ) %	
$\Gamma_9$ $D_{s1}(2536)^- \mu^+ \nu_\mu, D_{s1}^- \rightarrow D_s^{*-} K_S^0$	( 2.7 ± 0.7 ) × 10 <sup>-3</sup>	
$\Gamma_{10}$ $D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+$	( 4.4 ± 1.3 ) × 10 <sup>-3</sup>	
$\Gamma_{11}$ $D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+$	( 2.7 ± 1.0 ) × 10 <sup>-3</sup>	
$\Gamma_{12}$ $K^- \mu^+ \nu_\mu$	( 1.06 ± 0.09 ) × 10 <sup>-4</sup>	
$\Gamma_{13}$ $D_s^- \pi^+$	( 2.98 ± 0.14 ) × 10 <sup>-3</sup>	
$\Gamma_{14}$ $D_s^- \rho^+$	( 6.8 ± 1.4 ) × 10 <sup>-3</sup>	
$\Gamma_{15}$ $D_s^- \pi^+ \pi^+ \pi^-$	( 6.1 ± 1.0 ) × 10 <sup>-3</sup>	
$\Gamma_{16}$ $D_{s1}(2536)^- \pi^+, D_{s1}^- \rightarrow D_s^- \pi^+ \pi^-$	( 2.4 ± 0.8 ) × 10 <sup>-5</sup>	
$\Gamma_{17}$ $D_s^\mp K^\pm$	( 2.25 ± 0.12 ) × 10 <sup>-4</sup>	
$\Gamma_{18}$ $D_s^- K^+ \pi^+ \pi^-$	( 3.2 ± 0.6 ) × 10 <sup>-4</sup>	
$\Gamma_{19}$ $D_s^+ D_s^-$	( 4.4 ± 0.5 ) × 10 <sup>-3</sup>	
$\Gamma_{20}$ $D_s^- D^+$	( 2.8 ± 0.5 ) × 10 <sup>-4</sup>	
$\Gamma_{21}$ $D^+ D^-$	( 2.2 ± 0.6 ) × 10 <sup>-4</sup>	
$\Gamma_{22}$ $D^{*+} D^-$		
$\Gamma_{23}$ $D^{*-} D^+$		
$\Gamma_{24}$ $D^0 \bar{D}^0$	( 1.9 ± 0.5 ) × 10 <sup>-4</sup>	
$\Gamma_{25}$ $D_s^{*-} \pi^+$	( 1.9 $^{+0.5}_{-0.4}$ ) × 10 <sup>-3</sup>	
$\Gamma_{26}$ $D_s^{*\mp} K^\pm$	( 1.32 $^{+0.40}_{-0.32}$ ) × 10 <sup>-4</sup>	
$\Gamma_{27}$ $D_s^{*-} \rho^+$	( 9.5 ± 2.0 ) × 10 <sup>-3</sup>	
$\Gamma_{28}$ $D_s^{*+} D_s^- + D_s^{*-} D_s^+$	( 1.39 ± 0.17 ) %	
$\Gamma_{29}$ $D_s^{*+} D_s^{*-}$	( 1.44 ± 0.21 ) %	S=1.1
$\Gamma_{30}$ $D_s^{(*)+} D_s^{(*)-}$	( 4.5 ± 1.4 ) %	
$\Gamma_{31}$ $D_s^{*-} D_s^+$	( 3.9 ± 0.8 ) × 10 <sup>-4</sup>	
$\Gamma_{32}$ $\bar{D}^{*0} \bar{K}^0$	( 2.8 ± 1.1 ) × 10 <sup>-4</sup>	
$\Gamma_{33}$ $\bar{D}^0 \bar{K}^0$	( 4.3 ± 0.9 ) × 10 <sup>-4</sup>	

$\Gamma_{34}$	$\bar{D}^0 K^- \pi^+$	$(1.04 \pm 0.13) \times 10^{-3}$	
$\Gamma_{35}$	$\bar{D}^*(2007)^0 K^- \pi^+$	$(7.3 \pm 2.6) \times 10^{-4}$	
$\Gamma_{36}$	$\bar{D}^0 \bar{K}^*(892)^0$	$(4.4 \pm 0.6) \times 10^{-4}$	
$\Gamma_{37}$	$\bar{D}^0 \bar{K}^*(1410)$	$(3.9 \pm 3.5) \times 10^{-4}$	
$\Gamma_{38}$	$\bar{D}^0 \bar{K}_0^*(1430)$	$(3.0 \pm 0.7) \times 10^{-4}$	
$\Gamma_{39}$	$\bar{D}^0 \bar{K}_2^*(1430)$	$(1.1 \pm 0.4) \times 10^{-4}$	
$\Gamma_{40}$	$\bar{D}^0 \bar{K}^*(1680)$	$< 7.8 \times 10^{-5}$	CL=90%
$\Gamma_{41}$	$\bar{D}^0 \bar{K}_0^*(1950)$	$< 1.1 \times 10^{-4}$	CL=90%
$\Gamma_{42}$	$\bar{D}^0 \bar{K}_3^*(1780)$	$< 2.6 \times 10^{-5}$	CL=90%
$\Gamma_{43}$	$\bar{D}^0 \bar{K}_4^*(2045)$	$< 3.1 \times 10^{-5}$	CL=90%
$\Gamma_{44}$	$\bar{D}^0 K^- \pi^+$ (non-resonant)	$(2.1 \pm 0.8) \times 10^{-4}$	
$\Gamma_{45}$	$D_{s2}^*(2573)^- \pi^+$ , $D_{s2}^* \rightarrow \bar{D}^0 K^-$	$(2.6 \pm 0.4) \times 10^{-4}$	
$\Gamma_{46}$	$D_{s1}^*(2700)^- \pi^+$ , $D_{s1}^* \rightarrow \bar{D}^0 K^-$	$(1.6 \pm 0.8) \times 10^{-5}$	
$\Gamma_{47}$	$D_{s1}^*(2860)^- \pi^+$ , $D_{s1}^* \rightarrow \bar{D}^0 K^-$	$(5 \pm 4) \times 10^{-5}$	
$\Gamma_{48}$	$D_{s3}^*(2860)^- \pi^+$ , $D_{s3}^* \rightarrow \bar{D}^0 K^-$	$(2.2 \pm 0.6) \times 10^{-5}$	
$\Gamma_{49}$	$\bar{D}^0 K^+ K^-$	$(5.6 \pm 0.9) \times 10^{-5}$	
$\Gamma_{50}$	$\bar{D}^0 f_0(980)$	$< 3.1 \times 10^{-6}$	CL=90%
$\Gamma_{51}$	$\bar{D}^0 \phi$	$(3.0 \pm 0.5) \times 10^{-5}$	
$\Gamma_{52}$	$\bar{D}^{*0} \phi$	$(3.7 \pm 0.6) \times 10^{-5}$	
$\Gamma_{53}$	$D^{*\mp} \pi^\pm$	$< 6.1 \times 10^{-6}$	CL=90%
$\Gamma_{54}$	$\eta_c \phi$	$(5.0 \pm 0.9) \times 10^{-4}$	
$\Gamma_{55}$	$\eta' X_{s\bar{s}}$		
$\Gamma_{56}$	$\eta_c \pi^+ \pi^-$	$(1.8 \pm 0.7) \times 10^{-4}$	
$\Gamma_{57}$	$J/\psi(1S) \phi$	$(1.04 \pm 0.04) \times 10^{-3}$	
$\Gamma_{58}$	$J/\psi(1S) \phi \phi$	$(1.20_{-0.16}^{+0.14}) \times 10^{-5}$	
$\Gamma_{59}$	$J/\psi(1S) \pi^0$	$< 1.2 \times 10^{-3}$	CL=90%
$\Gamma_{60}$	$J/\psi(1S) \eta$	$(4.0 \pm 0.7) \times 10^{-4}$	S=1.4
$\Gamma_{61}$	$J/\psi(1S) K_S^0$	$(1.92 \pm 0.14) \times 10^{-5}$	
$\Gamma_{62}$	$J/\psi(1S) \bar{K}^*(892)^0$	$(4.1 \pm 0.4) \times 10^{-5}$	
$\Gamma_{63}$	$J/\psi(1S) \eta'$	$(3.3 \pm 0.4) \times 10^{-4}$	
$\Gamma_{64}$	$J/\psi(1S) \pi^+ \pi^-$	$(2.02 \pm 0.17) \times 10^{-4}$	S=1.7
$\Gamma_{65}$	$J/\psi(1S) f_0(500)$ , $f_0 \rightarrow \pi^+ \pi^-$	$< 4 \times 10^{-6}$	CL=90%
$\Gamma_{66}$	$J/\psi(1S) \rho$ , $\rho \rightarrow \pi^+ \pi^-$	$< 3.4 \times 10^{-6}$	CL=90%
$\Gamma_{67}$	$J/\psi(1S) f_0(980)$ , $f_0 \rightarrow \pi^+ \pi^-$	$(1.24 \pm 0.15) \times 10^{-4}$	S=2.1
$\Gamma_{68}$	$J/\psi(1S) f_2(1270)$ , $f_2 \rightarrow \pi^+ \pi^-$	$(1.0 \pm 0.4) \times 10^{-6}$	
$\Gamma_{69}$	$J/\psi(1S) f_2(1270)_0$ , $f_2 \rightarrow \pi^+ \pi^-$	$(7.3 \pm 1.7) \times 10^{-7}$	

$\Gamma_{70}$	$J/\psi(1S) f_2(1270)_{\parallel}, f_2 \rightarrow \pi^+ \pi^-$	$(1.05 \pm 0.33) \times 10^{-6}$	
$\Gamma_{71}$	$J/\psi(1S) f_2(1270)_{\perp}, f_2 \rightarrow \pi^+ \pi^-$	$(1.3 \pm 0.7) \times 10^{-6}$	
$\Gamma_{72}$	$J/\psi(1S) f_0(1370), f_0 \rightarrow \pi^+ \pi^-$	$(4.4 \pm_{-4.0}^{0.6}) \times 10^{-5}$	
$\Gamma_{73}$	$J/\psi(1S) f_0(1500), f_0 \rightarrow \pi^+ \pi^-$	$(2.04 \pm_{-0.24}^{0.32}) \times 10^{-5}$	
$\Gamma_{74}$	$J/\psi(1S) f'_2(1525)_0, f'_2 \rightarrow \pi^+ \pi^-$	$(1.03 \pm 0.22) \times 10^{-6}$	
$\Gamma_{75}$	$J/\psi(1S) f'_2(1525)_{\parallel}, f'_2 \rightarrow \pi^+ \pi^-$	$(1.2 \pm_{-0.8}^{2.6}) \times 10^{-7}$	
$\Gamma_{76}$	$J/\psi(1S) f'_2(1525)_{\perp}, f'_2 \rightarrow \pi^+ \pi^-$	$(5 \pm 4) \times 10^{-7}$	
$\Gamma_{77}$	$J/\psi(1S) f_0(1790), f_0 \rightarrow \pi^+ \pi^-$	$(4.9 \pm_{-1.0}^{10.0}) \times 10^{-6}$	
$\Gamma_{78}$	$J/\psi(1S) \pi^+ \pi^-$ (nonresonant)	$(1.74 \pm_{-0.34}^{1.10}) \times 10^{-5}$	
$\Gamma_{79}$	$J/\psi(1S) \bar{K}^0 \pi^+ \pi^-$	$< 4.4 \times 10^{-5}$	CL=90%
$\Gamma_{80}$	$J/\psi(1S) K^+ K^-$	$(7.9 \pm 0.7) \times 10^{-4}$	
$\Gamma_{81}$	$J/\psi(1S) K^0 K^- \pi^+ + \text{c.c.}$	$(9.5 \pm 1.3) \times 10^{-4}$	
$\Gamma_{82}$	$J/\psi(1S) \bar{K}^0 K^+ K^-$	$< 1.2 \times 10^{-5}$	CL=90%
$\Gamma_{83}$	$J/\psi K^*(892)^0 \bar{K}^*(892)^0$	$(1.10 \pm 0.09) \times 10^{-4}$	
$\Gamma_{84}$	$J/\psi(1S) f'_2(1525)$	$(2.6 \pm 0.6) \times 10^{-4}$	
$\Gamma_{85}$	$J/\psi(1S) p \bar{p}$	$(3.6 \pm 0.4) \times 10^{-6}$	
$\Gamma_{86}$	$J/\psi(1S) \gamma$	$< 7.3 \times 10^{-6}$	CL=90%
$\Gamma_{87}$	$J/\psi \mu^+ \mu^-, J/\psi \rightarrow \mu^+ \mu^-$	$< 2.6 \times 10^{-9}$	CL=95%
$\Gamma_{88}$	$J/\psi(1S) \pi^+ \pi^- \pi^+ \pi^-$	$(7.5 \pm 0.8) \times 10^{-5}$	
$\Gamma_{89}$	$J/\psi(1S) f_1(1285)$	$(7.2 \pm 1.4) \times 10^{-5}$	
$\Gamma_{90}$	$\psi(2S) \eta$	$(3.3 \pm 0.9) \times 10^{-4}$	
$\Gamma_{91}$	$\psi(2S) \eta'$	$(1.29 \pm 0.35) \times 10^{-4}$	
$\Gamma_{92}$	$\psi(2S) \pi^+ \pi^-$	$(6.9 \pm 1.2) \times 10^{-5}$	
$\Gamma_{93}$	$\psi(2S) \phi$	$(5.2 \pm 0.4) \times 10^{-4}$	
$\Gamma_{94}$	$\psi(2S) K^0$	$(1.9 \pm 0.5) \times 10^{-5}$	
$\Gamma_{95}$	$\psi(2S) K^- \pi^+$	$(3.1 \pm 0.4) \times 10^{-5}$	
$\Gamma_{96}$	$\psi(2S) \bar{K}^*(892)^0$	$(3.3 \pm 0.5) \times 10^{-5}$	
$\Gamma_{97}$	$\chi_{c1} \phi$	$(1.97 \pm 0.25) \times 10^{-4}$	
$\Gamma_{98}$	$\chi_{c1} K^+ K^-$		
$\Gamma_{99}$	$\chi_{c2} K^+ K^-$		
$\Gamma_{100}$	$\chi_{c1}(3872) \phi$	$(1.1 \pm 0.4) \times 10^{-4}$	
$\Gamma_{101}$	$\chi_{c1}(3872) (K^+ K^-)_{non-\phi}$	$(8.6 \pm 3.5) \times 10^{-5}$	
$\Gamma_{102}$	$\pi^+ \pi^-$	$(7.0 \pm 1.0) \times 10^{-7}$	
$\Gamma_{103}$	$\pi^0 \pi^0$	$< 2.1 \times 10^{-4}$	CL=90%
$\Gamma_{104}$	$\eta \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%

$\Gamma_{105}$	$\eta\eta$	$< 1.43$	$\times 10^{-4}$	CL=90%
$\Gamma_{106}$	$\rho^0\rho^0$	$< 3.20$	$\times 10^{-4}$	CL=90%
$\Gamma_{107}$	$\eta'K_S^0$	$< 8.16$	$\times 10^{-6}$	CL=90%
$\Gamma_{108}$	$\eta'\eta$	$< 6.5$	$\times 10^{-5}$	CL=90%
$\Gamma_{109}$	$\eta'\eta'$	$(3.3 \pm 0.7)$	$\times 10^{-5}$	
$\Gamma_{110}$	$\eta'\phi$	$< 8.2$	$\times 10^{-7}$	CL=90%
$\Gamma_{111}$	$\phi f_0(980), f_0(980) \rightarrow \pi^+\pi^-$	$(1.12 \pm 0.21)$	$\times 10^{-6}$	
$\Gamma_{112}$	$\phi f_2(1270), f_2(1270) \rightarrow \pi^+\pi^-$	$(6.1 \pm 1.8)$	$\times 10^{-7}$	
$\Gamma_{113}$	$\phi\rho^0$	$(2.7 \pm 0.8)$	$\times 10^{-7}$	
$\Gamma_{114}$	$\phi\pi^+\pi^-$	$(3.5 \pm 0.5)$	$\times 10^{-6}$	
$\Gamma_{115}$	$\phi\phi$	$(1.85 \pm 0.14)$	$\times 10^{-5}$	
$\Gamma_{116}$	$\phi\phi\phi$	$(2.2 \pm 0.6)$	$\times 10^{-6}$	
$\Gamma_{117}$	$\pi^+K^-$	$(5.8 \pm 0.7)$	$\times 10^{-6}$	
$\Gamma_{118}$	$K^+K^-$	$(2.66 \pm 0.22)$	$\times 10^{-5}$	
$\Gamma_{119}$	$K^0\bar{K}^0$	$(1.76 \pm 0.31)$	$\times 10^{-5}$	
$\Gamma_{120}$	$K^0\pi^+\pi^-$	$(9.5 \pm 2.1)$	$\times 10^{-6}$	
$\Gamma_{121}$	$K^0K^\pm\pi^\mp$	$(8.4 \pm 0.9)$	$\times 10^{-5}$	
$\Gamma_{122}$	$K^*(892)^-\pi^+$	$(2.9 \pm 1.1)$	$\times 10^{-6}$	
$\Gamma_{123}$	$K^*(892)^\pm K^\mp$	$(1.9 \pm 0.5)$	$\times 10^{-5}$	
$\Gamma_{124}$	$K_0^*(1430)^\pm K^\mp$	$(3.1 \pm 2.5)$	$\times 10^{-5}$	
$\Gamma_{125}$	$K_2^*(1430)^\pm K^\mp$	$(1.0 \pm 1.7)$	$\times 10^{-5}$	
$\Gamma_{126}$	$K^*(892)^0\bar{K}^0 + \text{c.c.}$	$(2.0 \pm 0.6)$	$\times 10^{-5}$	
$\Gamma_{127}$	$K_0^*(1430)\bar{K}^0 + \text{c.c.}$	$(3.3 \pm 1.0)$	$\times 10^{-5}$	
$\Gamma_{128}$	$K_2^*(1430)^0\bar{K}^0 + \text{c.c.}$	$(1.7 \pm 2.2)$	$\times 10^{-5}$	
$\Gamma_{129}$	$K_S^0\bar{K}^*(892)^0 + \text{c.c.}$	$(1.6 \pm 0.4)$	$\times 10^{-5}$	
$\Gamma_{130}$	$K^0K^+K^-$	$(1.3 \pm 0.6)$	$\times 10^{-6}$	
$\Gamma_{131}$	$\bar{K}^*(892)^0\rho^0$	$< 7.67$	$\times 10^{-4}$	CL=90%
$\Gamma_{132}$	$\bar{K}^*(892)^0K^*(892)^0$	$(1.11 \pm 0.27)$	$\times 10^{-5}$	
$\Gamma_{133}$	$K^*(892)^0\bar{K}_2^*(1430)^0$			
$\Gamma_{134}$	$K_2^*(1430)^0\bar{K}^*(892)^0$			
$\Gamma_{135}$	$K_2^*(1430)^0\bar{K}_2^*(1430)^0$			
$\Gamma_{136}$	$\phi K^*(892)^0$	$(1.14 \pm 0.30)$	$\times 10^{-6}$	
$\Gamma_{137}$	$\rho\bar{\rho}$	$< 1.5$	$\times 10^{-8}$	CL=90%
$\Gamma_{138}$	$\rho\bar{\rho}K^+K^-$	$(4.5 \pm 0.5)$	$\times 10^{-6}$	
$\Gamma_{139}$	$\rho\bar{\rho}K^+\pi^-$	$(1.39 \pm 0.26)$	$\times 10^{-6}$	
$\Gamma_{140}$	$\rho\bar{\rho}\pi^+\pi^-$	$(4.3 \pm 2.0)$	$\times 10^{-7}$	
$\Gamma_{141}$	$\rho\bar{\Lambda}K^- + \text{c.c.}$	$(5.5 \pm 1.0)$	$\times 10^{-6}$	
$\Gamma_{142}$	$\Lambda_c^-\Lambda\pi^+$	$(3.6 \pm 1.6)$	$\times 10^{-4}$	
$\Gamma_{143}$	$\Lambda_c^-\Lambda_c^+$	$< 8.0$	$\times 10^{-5}$	CL=95%

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

$\Gamma_{144}$	$\gamma\gamma$	<i>B1</i>	< 3.1	$\times 10^{-6}$	CL=90%
$\Gamma_{145}$	$\phi\gamma$	<i>B1</i>	( 3.4 $\pm$ 0.4 )	$\times 10^{-5}$	
$\Gamma_{146}$	$\mu^+\mu^-$	<i>B1</i>	( 3.01 $\pm$ 0.35 )	$\times 10^{-9}$	
$\Gamma_{147}$	$e^+e^-$	<i>B1</i>	< 9.4	$\times 10^{-9}$	CL=90%
$\Gamma_{148}$	$\tau^+\tau^-$	<i>B1</i>	< 6.8	$\times 10^{-3}$	CL=95%
$\Gamma_{149}$	$\mu^+\mu^-\gamma$		< 2.0	$\times 10^{-9}$	
$\Gamma_{150}$	$\mu^+\mu^-\mu^+\mu^-$	<i>B1</i>	< 8.6	$\times 10^{-10}$	CL=95%
$\Gamma_{151}$	$SP, S \rightarrow \mu^+\mu^-,$ $P \rightarrow \mu^+\mu^-$	<i>B1</i>	[ <i>b</i> ] < 2.2	$\times 10^{-9}$	CL=95%
$\Gamma_{152}$	$aa, a \rightarrow \mu^+\mu^-$		< 5.8	$\times 10^{-10}$	CL=95%
$\Gamma_{153}$	$\phi(1020)\mu^+\mu^-$	<i>B1</i>	( 8.4 $\pm$ 0.4 )	$\times 10^{-7}$	
$\Gamma_{154}$	$f'_2(1525)\mu^+\mu^-$		( 1.62 $\pm$ 0.22 )	$\times 10^{-7}$	
$\Gamma_{155}$	$\bar{K}^*(892)^0\mu^+\mu^-$	<i>B1</i>	( 2.9 $\pm$ 1.1 )	$\times 10^{-8}$	
$\Gamma_{156}$	$\pi^+\pi^-\mu^+\mu^-$	<i>B1</i>	( 8.4 $\pm$ 1.7 )	$\times 10^{-8}$	
$\Gamma_{157}$	$\phi\nu\bar{\nu}$	<i>B1</i>	< 5.4	$\times 10^{-3}$	CL=90%
$\Gamma_{158}$	$e^\pm\mu^\mp$	<i>LF</i>	[ <i>c</i> ] < 5.4	$\times 10^{-9}$	CL=90%
$\Gamma_{159}$	$\mu^\pm\tau^\mp$	<i>LF</i>	< 4.2	$\times 10^{-5}$	CL=95%

[*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/ $c^2$  and 214.3 MeV/ $c^2$ , respectively.

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

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**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  $\chi^2 = 26.9$  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.

$x_{15}$	17					
$x_{17}$	82	14				
$x_{57}$	0	0	0			
$x_{64}$	0	0	0	43		
$x_{67}$	0	0	0	31	52	
$x_{115}$	0	0	0	15	6	5
	$x_{13}$	$x_{15}$	$x_{17}$	$x_{57}$	$x_{64}$	$x_{67}$

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## $B_s^0$ 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>0.62 ± 0.06 OUR AVERAGE</b>				
0.602 ± 0.058 ± 0.023		1 WANG	22 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$
0.91 ± 0.18 ± 0.41		2 DRUTSKOY	07 BELL	$e^+ e^- \rightarrow \Upsilon(4S)$
0.81 ± 0.24 ± 0.22	90	3 BUSKULIC	96E ALEP	$e^+ e^- \rightarrow Z$
1.56 ± 0.58 ± 0.44	147	4 ACTON	92N OPAL	$e^+ e^- \rightarrow Z$

<sup>1</sup> WANG 22 selects the  $B_s$  events by tagging the accompanying  $B_s$  via partial reconstruction of the semileptonic decays  $B_s \rightarrow D_s X \ell^+ \nu$ .

<sup>2</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>3</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>4</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	1 OSWALD	13 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$
9.5 <sup>+2.5+1.1</sup> <sub>-2.0-1.9</sub>	2 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	$e^+ e^- \rightarrow \Upsilon(5S)$

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

<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	$e^+ e^- \rightarrow \Upsilon(5S)$

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

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.

$\Gamma(D_s^- \mu^+ \nu_\mu)/\Gamma_{\text{total}}$   $\Gamma_7/\Gamma$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>2.44 \pm 0.21 \pm 0.10</math></b>	<sup>1</sup> AAIJ	20E	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 20E reports  $[\Gamma(B_s^0 \rightarrow D_s^- \mu^+ \nu_\mu)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^- \ell^+ \nu_\ell)] = 1.09 \pm 0.05 \pm 0.06 \pm 0.05$  which we multiply by our best value  $B(B^0 \rightarrow D^- \ell^+ \nu_\ell) = (2.24 \pm 0.09) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^{*-} \mu^+ \nu_\mu)/\Gamma_{\text{total}}$   $\Gamma_8/\Gamma$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>5.3 \pm 0.5 \pm 0.1</math></b>	<sup>1</sup> AAIJ	20E	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 20E reports  $[\Gamma(B_s^0 \rightarrow D_s^{*-} \mu^+ \nu_\mu)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^*(2010)^- \ell^+ \nu_\ell)] = 1.06 \pm 0.05 \pm 0.07 \pm 0.05$  which we multiply by our best value  $B(B^0 \rightarrow D^*(2010)^- \ell^+ \nu_\ell) = (4.97 \pm 0.12) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^- \mu^+ \nu_\mu)/\Gamma(D_s^{*-} \mu^+ \nu_\mu)$   $\Gamma_7/\Gamma_8$

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

$0.464 \pm 0.013 \pm 0.043$	<sup>1</sup> AAIJ	20E	LHCB $pp$ at 7, 8 TeV
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<sup>1</sup> AAIJ 20E value is not independent of other reported measurements.

$\Gamma(D_{s1}(2536)^- \mu^+ \nu_\mu, D_{s1}^- \rightarrow D^{*-} K_S^0)/\Gamma_{\text{total}}$   $\Gamma_9/\Gamma$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>2.7 \pm 0.7 \pm 0.2</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  $B(\bar{b} \rightarrow B_s^0) = (10.0 \pm 0.8) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+)/\Gamma(D_s^- \ell^+ \nu_\ell \text{ anything})$   $\Gamma_{10}/\Gamma_5$

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

$\Gamma(D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+)/\Gamma(D_s^- \ell^+ \nu_\ell \text{ anything})$   $\Gamma_{11}/\Gamma_5$

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

$\Gamma(D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+)/\Gamma(D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+)$   $\Gamma_{10}/\Gamma_{11}$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • 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
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<sup>1</sup> Not independent of other AAIJ 11A measurements.

$\Gamma(K^- \mu^+ \nu_\mu)/\Gamma(D_s^- \mu^+ \nu_\mu)$   $\Gamma_{12}/\Gamma_7$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>4.89 \pm 0.21 \pm 0.25</math></b>	<sup>1,2</sup> AAIJ	21G	LHCB $pp$ at 8 TeV

<sup>1</sup> AAIJ 21G measures  $B(B_s^0 \rightarrow K^- \mu^+ \nu_\mu)/B(B_s^0 \rightarrow D_s^- \mu^+ \nu_\mu) = (4.89 \pm 0.21_{-0.21}^{+0.20} \pm 0.14) \times 10^{-3}$  over the whole  $q^2$  range, where the last uncertainty is due to the  $D_s^- \rightarrow K^+ K^- \pi^-$  branching fraction.

<sup>2</sup> AAIJ 21G reports this branching ratio for  $q^2 < 7 \text{ GeV}^2$  as  $(1.66 \pm 0.08 \pm 0.07 \pm 0.05) \times 10^{-3}$  and for  $q^2 > 7 \text{ GeV}^2$  as  $(3.25 \pm 0.21_{-0.17}^{+0.16} \pm 0.09) \times 10^{-3}$ .

$\Gamma(K^- \mu^+ \nu_\mu)/\Gamma_{\text{total}}$   $\Gamma_{12}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>1.06 \pm 0.05 \pm 0.08</math></b>	<sup>1</sup> AAIJ	21G	LHCB $pp$ at 8 TeV

<sup>1</sup> The total systematic error includes  $D_s^-$  branching fractions,  $B_s^0$  lifetime,  $|V_{cb}|$ , and  $B_s^0 \rightarrow D_s^-$  form factor integral uncertainties.

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

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>2.98 \pm 0.14</math> OUR FIT</b>				
<b><math>2.97 \pm 0.13</math> OUR AVERAGE</b>				

$2.96 \pm 0.10 \pm 0.09$	<sup>1</sup> AAIJ	21Y	LHCB	$pp$ at 7, 8, 13 TeV
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$3.6 \pm 0.5 \pm 0.5$	<sup>2</sup> LOUVOT	09	BELL	$e^+ e^- \rightarrow \Upsilon(5S)$
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$2.8 \pm 0.6 \pm 0.1$	<sup>3</sup> ABULENCIA	07C	CDF	$p\bar{p}$ at 1.96 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.95 \pm 0.05_{-0.28}^{+0.25}$	<sup>4</sup> AAIJ	12AG	LHCB	Repl. by AAIJ 21Y
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$6.8 \pm 2.2 \pm 1.6$	DRUTSKOY	07A	BELL	Repl. by LOUVOT 09
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$3.3 \pm 1.1 \pm 0.1$	<sup>5</sup> ABULENCIA	06J	CDF	Repl. by ABULENCIA 07C
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<130	<sup>6</sup> AKERS	94J	OPAL	$e^+ e^- \rightarrow Z$
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seen	<sup>1</sup> BUSKULIC	93G	ALEP	$e^+ e^- \rightarrow Z$
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<sup>1</sup> AAIJ 21Y reports  $[\Gamma(B_s^0 \rightarrow D_s^- \pi^+)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^- \pi^+)] = 1.18 \pm 0.04$  which we multiply by our best value  $B(B^0 \rightarrow D^- \pi^+) = (2.51 \pm 0.08) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

- <sup>2</sup> LOUVOT 09 reports  $(3.67^{+0.35+0.65}_{-0.33-0.645}) \times 10^{-3}$  from a measurement of  $[\Gamma(B_s^0 \rightarrow D_s^- \pi^+)/\Gamma_{\text{total}}] \times [B(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)})]$  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  $B(B^0 \rightarrow D^- \pi^+) = (2.51 \pm 0.08) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.
- <sup>4</sup> AAIJ 12AG reports  $(2.95 \pm 0.05 \pm 0.17^{+0.18}_{-0.22}) \times 10^{-3}$  where the last uncertainty comes from the semileptonic  $f_s/f_d$  measurement. We combined the systematics in quadrature.
- <sup>5</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  $B(B^0 \rightarrow D^- \pi^+) = (2.51 \pm 0.08) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.
- <sup>6</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  $B(\bar{b} \rightarrow B_s^0) = 0.105$ .

$\Gamma(D_s^- \rho^+)/\Gamma(D_s^- \pi^+)$	$\Gamma_{14}/\Gamma_{13}$		
VALUE	DOCUMENT ID	TECN	COMMENT
<b>2.3±0.4±0.2</b>	LOUVOT	10	BELL $e^+ e^- \rightarrow \Upsilon(5S)$

$\Gamma(D_s^- \pi^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$	$\Gamma_{15}/\Gamma$		
VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>6.1±1.0 OUR FIT</b>			
<b>6.3±1.4±0.6</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  $B(B^0 \rightarrow D^- \pi^+ \pi^+ \pi^-) = (6.0 \pm 0.6) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^- \pi^+ \pi^+ \pi^-)/\Gamma(D_s^- \pi^+)$	$\Gamma_{15}/\Gamma_{13}$		
VALUE	DOCUMENT ID	TECN	COMMENT
<b>2.05±0.33 OUR FIT</b>			
<b>2.01±0.37±0.20</b>	AAIJ	11E	LHCB $pp$ at 7 TeV

$\Gamma(D_{s1}(2536)^- \pi^+, D_{s1}^- \rightarrow D_s^- \pi^+ \pi^-)/\Gamma(D_s^- \pi^+ \pi^+ \pi^-)$	$\Gamma_{16}/\Gamma_{15}$		
VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>4.0±1.0±0.4</b>	AAIJ	12AX	LHCB $pp$ at 7 TeV

$\Gamma(D_s^\mp K^\pm)/\Gamma_{\text{total}}$   $\Gamma_{17}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.25 ± 0.12 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.

$\Gamma(D_s^\mp K^\pm)/\Gamma(D_s^- \pi^+)$   $\Gamma_{17}/\Gamma_{13}$

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

$\Gamma(D_s^- K^+ \pi^+ \pi^-)/\Gamma(D_s^- \pi^+ \pi^+ \pi^-)$   $\Gamma_{18}/\Gamma_{15}$

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

$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$   $\Gamma_{19}/\Gamma$

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 $e^+e^- \rightarrow \gamma(5S)$
5.4 ± 0.8 ± 0.8		<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  $1/2 f_s/f_d = 0.1230 \pm 0.0115$ . 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.

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

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

**$\Gamma(D^+ D^-)/\Gamma_{\text{total}}$   $\Gamma_{21}/\Gamma$**

<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 <i>pp</i> at 7 TeV

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

**$\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}}$   $\Gamma_{24}/\Gamma$**

<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 <i>pp</i> at 7 TeV

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

**$\Gamma(D_s^{*-} \pi^+)/\Gamma(D_s^- \pi^+)$   $\Gamma_{25}/\Gamma_{13}$**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.65^{+0.15}_{-0.13} \pm 0.07</math></b>	LOUVOT	10	BELL $e^+ e^- \rightarrow \gamma(5S)$

**$\Gamma(D_s^{*\mp} K^\pm)/\Gamma(D_s^{*-} \pi^+)$   $\Gamma_{26}/\Gamma_{25}$**

<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 <i>pp</i> at 7, 8 TeV

**$\Gamma(D_s^{*-} \rho^+)/\Gamma(D_s^- \pi^+)$   $\Gamma_{27}/\Gamma_{13}$**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>3.2 \pm 0.6 \pm 0.3</math></b>	LOUVOT	10	BELL $e^+ e^- \rightarrow \gamma(5S)$

**$\Gamma(D_s^{*-} \rho^+)/\Gamma(D_s^- \rho^+)$   $\Gamma_{27}/\Gamma_{14}$**

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

$1.4 \pm 0.3 \pm 0.1$	<sup>1</sup> LOUVOT	10	BELL $e^+ e^- \rightarrow \gamma(5S)$
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<sup>1</sup> Not independent of other LOUVOT 10 measurements.

$[\Gamma(D_s^{*+} D_s^-) + \Gamma(D_s^{*-} D_s^+)] / \Gamma_{\text{total}}$   $\Gamma_{28} / \Gamma$

VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**13.9 ± 1.7 OUR AVERAGE**

13.6 ± 1.0 ± 1.4		1 AAIJ	16P	LHCB $pp$ at 7 TeV
17.6 <sup>+2.3</sup> <sub>-2.2</sub> ± 4.0		2 ESEN	13	BELL $e^+e^- \rightarrow \Upsilon(5S)$
12.5 ± 1.7 ± 1.8		3 AALTONEN	12C	CDF $p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
27.5 <sup>+8.3</sup> <sub>-7.1</sub> ± 6.9		4 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  $1/2 f_s/f_d = 0.1230 \pm 0.0115$ . 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  $\Gamma(\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

$\Gamma(D_s^{*+} D_s^{*-}) / \Gamma_{\text{total}}$   $\Gamma_{29} / \Gamma$

VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**14.4 ± 2.1 OUR AVERAGE** Error includes scale factor of 1.1.

12.7 ± 1.3 ± 1.4		1 AAIJ	16P	LHCB $pp$ at 7 TeV
19.8 <sup>+3.3</sup> <sub>-3.1</sub> ± 5.2		2 ESEN	13	BELL $e^+e^- \rightarrow \Upsilon(5S)$
19.2 ± 2.9 ± 2.7		3 AALTONEN	12C	CDF $p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
30.8 <sup>+12.2</sup> <sub>-10.4</sub> ± 8.5		4 ESEN	10	BELL Repl. by ESEN 13
<257	90	DRUTSKOY	07A	BELL Repl. by ESEN 10

<sup>1</sup> AAIJ 16P reports  $[\Gamma(B_s^0 \rightarrow D_s^{*+} D_s^{*-}) / \Gamma_{\text{total}}] / [B(B^0 \rightarrow D^- D_s^+)] = 1.76 \pm 0.11 \pm 0.14$  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  $(f_s/f_d) (B(B_s^0 \rightarrow D_s^{*+} D_s^{*-}) / B(B^0 \rightarrow D^- D_s^+)) = 0.654 \pm 0.072 \pm 0.065$ . We multiply this result by our best value of  $B(B^0 \rightarrow D^- D_s^+) = (7.2 \pm 0.8) \times 10^{-3}$  and divide by our best value of  $f_s/f_d$ , where  $1/2 f_s/f_d = 0.1230 \pm 0.0115$ .



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

$\Gamma(D_s^{(*)+} D_s^{(*)-}) / \Gamma_{\text{total}}$   $\Gamma_{30} / \Gamma$

"OUR EVALUATION" is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFLAV, <https://hflav.web.cern.ch/>) and are described at <https://hflav.web.cern.ch/>. The averaging/rescaling procedure takes into account correlations between the measurements.

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<b>4.5 ± 1.4</b>				<b>OUR EVALUATION</b>
<b>3.4 ± 0.4</b>				<b>OUR AVERAGE</b>
3.07 ± 0.22 ± 0.33		<sup>1</sup> AAIJ	16P	LHCB $pp$ at 7 TeV
4.32 <sup>+0.42+1.04</sup> <sub>-0.39-1.03</sub>		<sup>2</sup> ESEN	13	BELL $e^+e^- \rightarrow \Upsilon(5S)$
3.7 ± 0.4 ± 0.5		<sup>3</sup> AALTONEN	12C	CDF $p\bar{p}$ at 1.96 TeV
3.5 ± 1.0 ± 1.1		<sup>4</sup> ABAZOV	09I	D0 $p\bar{p}$ at 1.96 TeV
14 ± 6 ± 3		<sup>5,6</sup> BARATE	00K	ALEP $e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.85 <sup>+1.53+1.79</sup> <sub>-1.30-1.80</sub>		<sup>7,8</sup> ESEN	10	BELL Repl. by ESEN 13
3.9 <sup>+1.9+1.6</sup> <sub>-1.7-1.5</sub>		<sup>4</sup> ABAZOV	07Y	D0 Repl. by ABAZOV 09I
<0.218	90	BARATE	98Q	ALEP $e^+e^- \rightarrow Z$

<sup>1</sup> AAIJ 16P reports  $[\Gamma(B_s^0 \rightarrow D_s^{(*)+} D_s^{(*)-}) / \Gamma_{\text{total}}] / [B(B^0 \rightarrow D^- D_s^+)] = 4.24 \pm 0.14 \pm 0.27$  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  $(f_s/f_d) (B(B_s^0 \rightarrow D_s^{(*)+} D_s^{(*)-}) / B(B^0 \rightarrow D^- D_s^+)) = 1.261 \pm 0.095 \pm 0.112$ . We multiply this result by our best value of  $B(B^0 \rightarrow D^- D_s^+) = (7.2 \pm 0.8) \times 10^{-3}$  and divide by our best value of  $f_s/f_d$ , where  $1/2 f_s/f_d = 0.1230 \pm 0.0115$ . 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  $\Gamma(\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*) / \Gamma(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

$\Gamma(D^{*-} D_s^+)/\Gamma_{\text{total}}$   $\Gamma_{31}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>3.9 \pm 0.6 \pm 0.5</math></b>	<sup>1</sup> AAIJ	21S	LHCB <i>pp</i> at 13 TeV

<sup>1</sup> AAIJ 21S reports  $[\Gamma(B_s^0 \rightarrow D^{*-} D_s^+)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^*(2010)^- D_s^+)] = 0.049 \pm 0.006 \pm 0.0036$  which we multiply by our best value  $B(B^0 \rightarrow D^*(2010)^- D_s^+) = (8.0 \pm 1.1) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$[\Gamma(D^{*+} D^-) + \Gamma(D^{*-} D^+)]/\Gamma_{\text{total}}$   $(\Gamma_{22} + \Gamma_{23})/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>8.4 \pm 1.1 \pm 0.8</math></b>	<sup>1</sup> AAIJ	21N	LHCB <i>pp</i> at 7, 8, 13 TeV

<sup>1</sup> AAIJ 21N reports  $[[\Gamma(B_s^0 \rightarrow D^{*+} D^-) + \Gamma(B_s^0 \rightarrow D^{*-} D^+)]/\Gamma_{\text{total}}] / [B(B^0 \rightarrow D^\pm D^{*\mp} (CP\text{-averaged}))] = 0.137 \pm 0.017 \pm 0.006$  which we multiply by our best value  $B(B^0 \rightarrow D^\pm D^{*\mp} (CP\text{-averaged})) = (6.1 \pm 0.6) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

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

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

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

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

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

$\Gamma(\overline{D}^0 K^- \pi^+)/\Gamma_{\text{total}}$   $\Gamma_{34}/\Gamma$

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

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

$\Gamma(\overline{D}^*(2007)^0 K^- \pi^+)/\Gamma_{\text{total}}$   $\Gamma_{35}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>7.3 \pm 0.6 \pm 2.5</math></b>	<sup>1</sup> AAIJ	22N	LHCB <i>pp</i> at 13 TeV

<sup>1</sup> AAIJ 22N reports  $[\Gamma(B_s^0 \rightarrow \overline{D}^*(2007)^0 K^- \pi^+)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \overline{D}^*(2007)^0 \pi^+ \pi^-)] = 1.178 \pm 0.029 \pm 0.091 \pm 0.037$  which we multiply by our best value  $B(B^0 \rightarrow \overline{D}^*(2007)^0 \pi^+ \pi^-) = (6.2 \pm 2.2) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\overline{D}^0 \overline{K}^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{36}/\Gamma$

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

4.29 ± 0.09 ± 0.65	1 AAIJ	14BH LHCB	pp at 7, 8 TeV
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4.7 ± 1.2 ± 0.3	2 AAIJ	11D LHCB	pp at 7 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

3.5 ± 0.4 ± 0.4	3 AAIJ	13BX LHCB	Repl. by AAIJ 14BH
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<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

<sup>2</sup> AAIJ 11D reports  $[\Gamma(B_S^0 \rightarrow \overline{D}^0 \overline{K}^*(892)^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \overline{D}^0 \rho^0)] = 1.48 \pm 0.34 \pm 0.19$  which we multiply by our best value  $B(B^0 \rightarrow \overline{D}^0 \rho^0) = (3.21 \pm 0.21) \times 10^{-4}$ . 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  $[\Gamma(B_S^0 \rightarrow \overline{D}^0 \overline{K}^*(892)^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \overline{D}^0 K^*(892)^0)] = 7.8 \pm 0.7 \pm 0.3 \pm 0.6$  which we multiply by our best value  $B(B^0 \rightarrow \overline{D}^0 K^*(892)^0) = (4.5 \pm 0.6) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\overline{D}^0 \overline{K}^*(1410))/\Gamma_{\text{total}}$   $\Gamma_{37}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
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<b>38.6 ± 11.4 ± 33.3</b>	1 AAIJ	14BH LHCB	pp at 7, 8 TeV
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<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

$\Gamma(\overline{D}^0 \overline{K}_0^*(1430))/\Gamma_{\text{total}}$   $\Gamma_{38}/\Gamma$

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

$\Gamma(\overline{D}^0 \overline{K}_2^*(1430))/\Gamma_{\text{total}}$   $\Gamma_{39}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
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<b>11.1 ± 1.8 ± 3.8</b>	1 AAIJ	14BH LHCB	pp at 7, 8 TeV
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<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

$\Gamma(\overline{D}^0 \overline{K}^*(1680))/\Gamma_{\text{total}}$   $\Gamma_{40}/\Gamma$

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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<b>&lt;7.8</b>	90	1 AAIJ	14BH LHCB	pp at 7, 8 TeV
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<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

$\Gamma(\overline{D}^0 \overline{K}_0^*(1950))/\Gamma_{\text{total}}$   $\Gamma_{41}/\Gamma$

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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<b>&lt;11</b>	90	1 AAIJ	14BH LHCB	pp at 7, 8 TeV
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<sup>1</sup> Uses Dalitz plot analysis of  $B_S^0 \rightarrow \overline{D}^0 K^- \pi^+$  decays.

$\Gamma(\overline{D}^0 \overline{K}_3^*(1780))/\Gamma_{\text{total}}$   $\Gamma_{42}/\Gamma$

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	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.

$\Gamma(\overline{D}^0 \overline{K}_4^*(2045))/\Gamma_{\text{total}}$   $\Gamma_{43}/\Gamma$

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<3.1	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.

$\Gamma(\overline{D}^0 K^- \pi^+ (\text{non-resonant}))/\Gamma_{\text{total}}$   $\Gamma_{44}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
$20.6 \pm 3.8 \pm 7.3$	<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.

$\Gamma(D_{s2}^*(2573)^- \pi^+, D_{s2}^* \rightarrow \overline{D}^0 K^-)/\Gamma_{\text{total}}$   $\Gamma_{45}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
$25.7 \pm 0.7 \pm 4.0$	<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.

$\Gamma(D_{s1}^*(2700)^- \pi^+, D_{s1}^* \rightarrow \overline{D}^0 K^-)/\Gamma_{\text{total}}$   $\Gamma_{46}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
$1.6 \pm 0.4 \pm 0.7$	<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.

$\Gamma(D_{s1}^*(2860)^- \pi^+, D_{s1}^* \rightarrow \overline{D}^0 K^-)/\Gamma_{\text{total}}$   $\Gamma_{47}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
$5.0 \pm 1.2 \pm 3.4$	<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.

$\Gamma(D_{s3}^*(2860)^- \pi^+, D_{s3}^* \rightarrow \overline{D}^0 K^-)/\Gamma_{\text{total}}$   $\Gamma_{48}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
$2.2 \pm 0.1 \pm 0.6$	<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.

$\Gamma(\overline{D}^0 K^+ K^-)/\Gamma_{\text{total}}$   $\Gamma_{49}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
$5.6 \pm 0.7 \pm 0.5$	<sup>1</sup> AAIJ	18AZ LHCB	$pp$ at 7, 8 TeV

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

$5.5 \pm 2.0 \pm 0.5$	<sup>2,3</sup> AAIJ	12AMLHCB	Repl. by AAIJ 18AZ
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<sup>1</sup> AAIJ 18AZ reports  $[\Gamma(B_s^0 \rightarrow \overline{D}^0 K^+ K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \overline{D}^0 K^+ K^-)] = 0.930 \pm 0.089 \pm 0.069$  which we multiply by our best value  $B(B^0 \rightarrow \overline{D}^0 K^+ K^-) = (6.1 \pm 0.5) \times$

$10^{-5}$ . 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 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  $B(B^0 \rightarrow \bar{D}^0 K^+ K^-) = (6.1 \pm 0.5) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>3</sup> Uses  $B(b \rightarrow B_S^0)/B(b \rightarrow B^0) = 0.267^{+0.023}_{-0.020}$  measured by the same authors.

$\Gamma(\bar{D}^0 f_0(980))/\Gamma_{\text{total}}$					$\Gamma_{50}/\Gamma$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<3.1 \times 10^{-6}$	90	AAIJ	15AG LHCB	$pp$ at 7, 8 TeV	

$\Gamma(\bar{D}^0 \phi)/\Gamma_{\text{total}}$					$\Gamma_{51}/\Gamma$
VALUE (units $10^{-5}$ )		DOCUMENT ID	TECN	COMMENT	
$3.0 \pm 0.4 \pm 0.2$		<sup>1</sup> AAIJ	18AY LHCB	$pp$ at 7 and 8 TeV	

<sup>1</sup> AAIJ 18AY reports  $[\Gamma(B_S^0 \rightarrow \bar{D}^0 \phi)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-)] = (3.4 \pm 0.4 \pm 0.3) \times 10^{-2}$  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.

$\Gamma(\bar{D}^0 \phi)/\Gamma(\bar{D}^0 \bar{K}^*(892)^0)$					$\Gamma_{51}/\Gamma_{36}$
VALUE		DOCUMENT ID	TECN	COMMENT	

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

$0.069 \pm 0.013 \pm 0.007$       AAIJ      13BX LHCB      Repl. by AAIJ 18AY

$\Gamma(\bar{D}^{*0} \phi)/\Gamma_{\text{total}}$					$\Gamma_{52}/\Gamma$
VALUE (units $10^{-5}$ )		DOCUMENT ID	TECN	COMMENT	
$3.7 \pm 0.6 \pm 0.2$		<sup>1</sup> AAIJ	18AY LHCB	$pp$ at 7 and 8 TeV	

<sup>1</sup> AAIJ 18AY reports  $[\Gamma(B_S^0 \rightarrow \bar{D}^{*0} \phi)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-)] = (4.2 \pm 0.5 \pm 0.4) \times 10^{-2}$  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.

$\Gamma(D^{*\mp} \pi^\pm)/\Gamma_{\text{total}}$					$\Gamma_{53}/\Gamma$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<6.1 \times 10^{-6}$	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  $B(B^0 \rightarrow D^{*-} \pi^+) = (2.76 \pm 0.13) \times 10^{-3}$ .

$\Gamma(\eta_c \phi)/\Gamma_{\text{total}}$					$\Gamma_{54}/\Gamma$
VALUE (units $10^{-4}$ )		DOCUMENT ID	TECN	COMMENT	
$5.01 \pm 0.53 \pm 0.68$		<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  $\phi(1020) \rightarrow K^+ K^-$ .

$\Gamma(\eta_c \pi^+ \pi^-) / \Gamma_{\text{total}}$   $\Gamma_{56} / \Gamma$

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.

$\Gamma(J/\psi(1S)\phi) / \Gamma_{\text{total}}$   $\Gamma_{57} / \Gamma$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.04 ± 0.04 OUR FIT</b>				
<b>1.04 ± 0.04 OUR AVERAGE</b>				

1.037 ± 0.032 ± 0.022		<sup>1</sup> AAIJ	21Y LHCB	$pp$ at 7, 8, 13 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. • • •

1.050 ± 0.013 ± 0.104		<sup>4</sup> AAIJ	13AN LHCB	Repl. by AAIJ 21Y
<6	1	<sup>5</sup> AKERS	94J OPAL	$e^+ e^- \rightarrow Z$
seen	14	<sup>6</sup> ABE	93F CDF	$p\bar{p}$ at 1.8 TeV
seen	1	<sup>7</sup> ACTON	92N OPAL	Sup. by AKERS 94J

<sup>1</sup>AAIJ 21Y reports  $[\Gamma(B_s^0 \rightarrow J/\psi(1S)\phi) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = (5.01 \pm 0.16 \pm 0.17) \times 10^{-4}$  from a measurement of  $[\Gamma(B_s^0 \rightarrow J/\psi(1S)\phi) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] / [B(B^+ \rightarrow J/\psi(1S)K^+)]$  assuming  $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.003 \pm 0.035) \times 10^{-3}$ , which we rescale to our best values  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ ,  $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.020 \pm 0.019) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup>THORNE 13 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  $\Gamma(\bar{b} \rightarrow B_s^0) / [\Gamma(\bar{b} \rightarrow B^+) + \Gamma(\bar{b} \rightarrow B^0)] = 0.1230 \pm 0.0115$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>4</sup>AAIJ 13AN 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>5</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>6</sup>ABE 93F measured using  $J/\psi(1S) \rightarrow \mu^+ \mu^-$  and  $\phi \rightarrow K^+ K^-$ .

<sup>7</sup>In ACTON 92N a limit on the product branching fraction is measured to be  $f(\bar{b} \rightarrow B_s^0) \cdot B(B_s^0 \rightarrow J/\psi(1S)\phi) \leq 0.22 \times 10^{-2}$ .

$\Gamma(J/\psi(1S)\phi\phi) / \Gamma(J/\psi(1S)\phi)$   $\Gamma_{58} / \Gamma_{57}$

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

$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$				$\Gamma_{59}/\Gamma$
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 $B_S$ ( $12.0 \pm 3.0\%$ ).				

$\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$				$\Gamma_{60}/\Gamma$
VALUE (units $10^{-4}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>4.0 ± 0.7 OUR AVERAGE</b>		Error includes scale factor of 1.4.		
3.6 $^{+0.5}_{-0.6}$ $^{+0.3}_{-0.2}$		<sup>1</sup> AAIJ	13A LHCb	$pp$ at 7 TeV
5.10 ± 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  $B_S$  ( $12.0 \pm 3.0\%$ ).

$\Gamma(J/\psi(1S)K_S^0)/\Gamma_{\text{total}}$				$\Gamma_{61}/\Gamma$
VALUE (units $10^{-5}$ )		DOCUMENT ID	TECN	COMMENT
<b>1.92 ± 0.14 OUR AVERAGE</b>				
1.92 ± 0.14 ± 0.05		<sup>1</sup> AAIJ	15AL LHCb	$pp$ at 7, 8 TeV
2.0 ± 0.4 ± 0.2		<sup>2</sup> AALTONEN	11A CDF	$p\bar{p}$ at 1.96 TeV
2.03 ± 0.16 ± 0.20		<sup>3</sup> AAIJ	13AB LHCb	Repl. by AAIJ 15AL
2.03 ± 0.26 ± 0.20		<sup>4</sup> AAIJ	12O LHCb	Repl. by AAIJ 13AB

- • • We do not use the following data for averages, fits, limits, etc. • • •
- <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  $B(B^0 \rightarrow J/\psi(1S)K_S^0) = (4.45 \pm 0.11) \times 10^{-4}$ . 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  $B(\bar{b} \rightarrow B_S^0) = (10.0 \pm 0.8) \times 10^{-2}$ ,  $B(\bar{b} \rightarrow B^0) = (40.8 \pm 0.7) \times 10^{-2}$ ,  $B(B^0 \rightarrow J/\psi(1S)K_S^0) = 1/2 \times B(B^0 \rightarrow J/\psi(1S)K^0) = 1/2 \times (8.91 \pm 0.21) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best 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  $B(B^0 \rightarrow J/\psi(1S)K^0) = (8.91 \pm 0.21) \times 10^{-4}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.246 \pm 0.023$ . 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  $B(B^0 \rightarrow J/\psi(1S)K^0) = (8.91 \pm 0.21) \times 10^{-4}$ ,  $\Gamma(\bar{b} \rightarrow B_S^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.246 \pm 0.023$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

### $\Gamma(J/\psi(1S)\bar{K}^*(892)^0)/\Gamma_{\text{total}}$ $\Gamma_{62}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<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
9 $\pm 4 \pm 1$	<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  $B(\bar{b} \rightarrow B_S^0) = (10.0 \pm 0.8) \times 10^{-2}$ ,  $B(\bar{b} \rightarrow B^0) = (40.8 \pm 0.7) \times 10^{-2}$ ,  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.27 \pm 0.05) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

### $\Gamma(J/\psi(1S)\eta')/\Gamma_{\text{total}}$ $\Gamma_{63}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<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  $N(B_S^{(*)}\bar{B}_S^{(*)})$ .



$\Gamma(J/\psi(1S)\eta')/\Gamma(J/\psi(1S)\eta)$   $\Gamma_{63}/\Gamma_{60}$

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 <sup>+0.06</sup> / <sub>-0.02</sub>	<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.

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{64}/\Gamma_{57}$

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  $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(J/\psi(1S)f_0(500), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)$   $\Gamma_{65}/\Gamma_{67}$

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.

$\Gamma(J/\psi(1S)\rho, \rho \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$   $\Gamma_{66}/\Gamma_{64}$

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.

$\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma_{total}$   $\Gamma_{67}/\Gamma$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.24 ± 0.15 OUR FIT</b> Error includes scale factor of 2.1.			
<b>1.16 <sup>+0.31 +0.30</sup>/<sub>-0.19 -0.25</sub></b>	<sup>1</sup> LI	11 BELL	$e^+e^- \rightarrow \gamma(5S)$

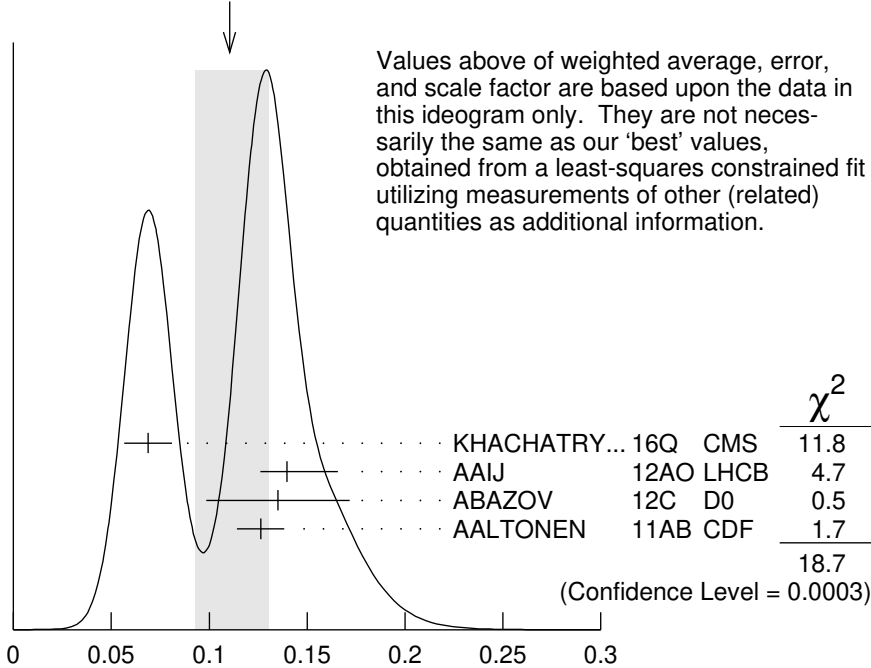
<sup>1</sup> The second error includes both the detector systematic and the uncertainty in the number of produced  $Y(5S) \rightarrow B_S^{(*)}\bar{B}_S^{(*)}$  pairs.

$\Gamma(J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{67}/\Gamma_{57}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.119 <sup>+0.013</sup>/<sub>-0.014</sub> OUR FIT</b> Error includes scale factor of 2.4.			
<b>0.110 <sup>+0.020</sup>/<sub>-0.018</sub> OUR AVERAGE</b> Error includes scale factor of 2.5. See the ideogram below.			
0.069 ± 0.012 ± 0.001	<sup>1</sup> KHACHATRY...16Q	CMS	$pp$ at 7 TeV
0.140 <sup>+0.026</sup> / <sub>-0.013</sub> ± 0.002	<sup>2,3</sup> AAIJ	12A0 LHCb	$pp$ at 7 TeV

$0.135 \pm 0.036 \pm 0.001$	<sup>4</sup> ABAZOV	12C D0	$\rho\bar{p}$ at 1.96 TeV
$0.126 \pm 0.012 \pm 0.001$	<sup>5</sup> AALTONEN	11AB CDF	$\rho\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$0.124^{+0.026}_{-0.023} \pm 0.001$	<sup>6</sup> AAIJ	11 LHCB	Repl. by AAIJ 12AO

WEIGHTED AVERAGE  
 $0.110^{+0.020}_{-0.018}$  (Error scaled by 2.5)



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

- <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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . 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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . 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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . 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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . 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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(J/\psi(1S) f_0(980), f_0 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-)$   $\Gamma_{67}/\Gamma_{64}$**

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.61</b> $^{+0.06}_{-0.07}$ <b>OUR FIT</b>			Error includes scale factor of 2.1.

<b>0.703 ± 0.015</b> $^{+0.004}_{-0.051}$	<sup>1</sup> AAIJ	14BR LHCb	<i>pp</i> at 7, 8 TeV
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<sup>1</sup> Reported first of two solutions using the full Dalitz analysis.

**$\Gamma(J/\psi(1S) f_2(1270), f_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \phi)$   $\Gamma_{68}/\Gamma_{57}$**

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>9.8</b> $^{+3.4}_{-3.6} \pm 0.1$	<sup>1,2</sup> AAIJ	12AO LHCb	<i>pp</i> 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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . 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  $\lambda = 0$ .

**$\Gamma(J/\psi(1S) f_2(1270)_0, f_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-)$   $\Gamma_{69}/\Gamma_{64}$**

VALUE (%)	DOCUMENT ID	TECN	COMMENT
<b>0.36 ± 0.07 ± 0.03</b>	<sup>1</sup> AAIJ	14BR LHCb	<i>pp</i> at 7, 8 TeV

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

**$\Gamma(J/\psi(1S) f_2(1270)_{||}, f_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-)$   $\Gamma_{70}/\Gamma_{64}$**

VALUE (%)	DOCUMENT ID	TECN	COMMENT
<b>0.52 ± 0.15</b> $^{+0.05}_{-0.02}$	<sup>1</sup> AAIJ	14BR LHCb	<i>pp</i> at 7, 8 TeV

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

**$\Gamma(J/\psi(1S) f_2(1270)_{\perp}, f_2 \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi(1S) \pi^+ \pi^-)$   $\Gamma_{71}/\Gamma_{64}$**

VALUE (%)	DOCUMENT ID	TECN	COMMENT
<b>0.63 ± 0.34</b> $^{+0.16}_{-0.08}$	<sup>1</sup> AAIJ	14BR LHCb	<i>pp</i> at 7, 8 TeV

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

**$\Gamma(J/\psi(1S) f_0(1370), f_0 \rightarrow \pi^+ \pi^-) / \Gamma_{total}$   $\Gamma_{72}/\Gamma$**

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

<b>0.34</b> $^{+0.11+0.085}_{-0.14-0.054}$	<sup>1</sup> LI	11 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$
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<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.

$\Gamma(J/\psi(1S)f_0(1370), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{72}/\Gamma_{57}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
$4.21^{+0.54}_{-3.76} \pm 0.05$	1,2 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  $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . 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.

$\Gamma(J/\psi(1S)f_0(1500), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$   $\Gamma_{73}/\Gamma_{64}$

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.

$\Gamma(J/\psi(1S)f_2'(1525)_0, f_2' \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$   $\Gamma_{74}/\Gamma_{64}$

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.

$\Gamma(J/\psi(1S)f_2'(1525)_{||}, f_2' \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$   $\Gamma_{75}/\Gamma_{64}$

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.

$\Gamma(J/\psi(1S)f_2'(1525)_{\perp}, f_2' \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$   $\Gamma_{76}/\Gamma_{64}$

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.

$\Gamma(J/\psi(1S)f_0(1790), f_0 \rightarrow \pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$   $\Gamma_{77}/\Gamma_{64}$

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.

$\Gamma(J/\psi(1S)\pi^+\pi^- (\text{nonresonant}))/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{78}/\Gamma_{57}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
$1.67^{+1.01}_{-0.32} \pm 0.02$	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  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . 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.

**$\Gamma(J/\psi(1S)\bar{K}^0\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{79}/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt;4.4 \times 10^{-5}</math></b>	90	<sup>1</sup> 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.

**$\Gamma(J/\psi(1S)K^+K^-)/\Gamma_{\text{total}}$   $\Gamma_{80}/\Gamma$**

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>7.9 \pm 0.7</math> OUR AVERAGE</b>			
$7.70 \pm 0.08 \pm 0.72$	<sup>1</sup> AAIJ	13AN	LHCB $pp$ at 7 TeV
$10.1 \pm 0.9 \pm 2.1$	<sup>2</sup> 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  $B_s^{(*)}\bar{B}_s^{(*)}$ .

**$\Gamma(J/\psi(1S)K^0K^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{81}/\Gamma$**

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>9.5 \pm 1.0 \pm 0.8</math></b>	<sup>1</sup> 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  $B(B^0 \rightarrow J/\psi(1S)K^0\pi^+\pi^-) = (4.5 \pm 0.4) \times 10^{-4}$ . 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.

**$\Gamma(J/\psi(1S)\bar{K}^0K^+K^-)/\Gamma_{\text{total}}$   $\Gamma_{82}/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt;12 \times 10^{-6}</math></b>	90	<sup>1</sup> 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.

**$\Gamma(J/\psi(1S)f_2'(1525))/\Gamma_{\text{total}}$   $\Gamma_{84}/\Gamma$**

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

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

**$\Gamma(J/\psi(1S)f_2'(1525))/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{84}/\Gamma_{57}$**

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>21 \pm 4</math> OUR AVERAGE</b>			
$21.5 \pm 4.9 \pm 2.6$	<sup>1</sup> THORNE	13	BELL $e^+e^- \rightarrow \Upsilon(5S)$
$21 \pm 7 \pm 1$	<sup>2,3</sup> ABZOV	12AF	D0 $p\bar{p}$ at 1.96 TeV

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

$27 \pm 4 \pm 1$	<sup>4</sup> AAIJ	12S	LHCB Repl. by AAIJ 13AN
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<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  $B(f_2'(1525) \rightarrow K^+ K^-) = \frac{1}{2} (87.6 \pm 2.2) \times 10^{-2}$ ,  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . 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  $B(f_2'(1525) \rightarrow K^+ K^-) = \frac{1}{2} (87.6 \pm 2.2) \times 10^{-2}$ ,  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

### $\Gamma(J/\psi(1S) p\bar{p})/\Gamma_{\text{total}}$ $\Gamma_{85}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>3.58 \pm 0.19 \pm 0.39</math></b>		<sup>1</sup> AAIJ	19U	LHCB $p\bar{p}$ at 7, 8, 13 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<4.8	90	<sup>2</sup> AAIJ	13Z	LHCB Repl. by AAIJ 19U
<sup>1</sup> Measured relative to $B_s^0 \rightarrow J/\psi \phi$ assuming $B(B_s^0 \rightarrow J/\psi \phi) = (10.5 \pm 0.13 \pm 0.64) \times 10^{-4}$ and taking into account small $K^+ K^-$ S-wave contribution.				
<sup>2</sup> Uses $B(B_s^0 \rightarrow J/\psi(1S) \pi^+ \pi^-) = (1.98 \pm 0.20) \times 10^{-4}$ .				

### $\Gamma(J/\psi(1S) \gamma)/\Gamma_{\text{total}}$ $\Gamma_{86}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 7.3 \times 10^{-6}</math></b>	90	<sup>1</sup> AAIJ	15BB	LHCB $p\bar{p}$ 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 $f_s/f_d = 0.259 \pm 0.015$ .				

### $\Gamma(J/\psi \mu^+ \mu^-, J/\psi \rightarrow \mu^+ \mu^-)/\Gamma_{\text{total}}$ $\Gamma_{87}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 2.6 \times 10^{-9}</math></b>	95	AAIJ	22Q	LHCB $p\bar{p}$ at 7, 8, 13 TeV

### $\Gamma(J/\psi(1S) \pi^+ \pi^- \pi^+ \pi^-)/\Gamma(J/\psi(1S) \pi^+ \pi^-)$ $\Gamma_{88}/\Gamma_{64}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.371 \pm 0.015 \pm 0.022</math></b>	<sup>1</sup> AAIJ	14Y	LHCB $p\bar{p}$ at 7,8 TeV
<sup>1</sup> Excludes contributions from $\psi(2S)$ and $\chi_{c1}(3872)$ decaying to $J/\psi(1S) \pi^+ \pi^-$ .			

### $\Gamma(J/\psi(1S) f_1(1285))/\Gamma_{\text{total}}$ $\Gamma_{89}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>7.2 \pm 1.3 \pm 0.4</math></b>	<sup>1</sup> AAIJ	14Y	LHCB $p\bar{p}$ 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 $B(f_1(1285) \rightarrow 2\pi^+ 2\pi^-) = (10.9 \pm 0.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.			

**$\Gamma(\psi(2S)\eta)/\Gamma(J/\psi(1S)\eta)$   $\Gamma_{90}/\Gamma_{60}$**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.83±0.14±0.12</b>	<sup>1</sup> AAIJ	13AA LHCB	<i>pp</i> 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.

**$\Gamma(\psi(2S)\eta')/\Gamma(J/\psi(1S)\eta')$   $\Gamma_{91}/\Gamma_{63}$**

<u>VALUE (units 10<sup>-2</sup>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>38.7±9.0±1.6</b>	<sup>1</sup> AAIJ	15D LHCB	<i>pp</i> 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.

**$\Gamma(\psi(2S)\pi^+ \pi^-)/\Gamma(J/\psi(1S)\pi^+ \pi^-)$   $\Gamma_{92}/\Gamma_{64}$**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.34±0.04±0.03</b>	<sup>1</sup> AAIJ	13AA LHCB	<i>pp</i> 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.

**$\Gamma(\psi(2S)\phi)/\Gamma_{\text{total}}$   $\Gamma_{93}/\Gamma$**

<u>VALUE (units 10<sup>-4</sup>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	1	BUSKULIC	93G ALEP	$e^+ e^- \rightarrow Z$
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**$\Gamma(\psi(2S)\phi)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{93}/\Gamma_{57}$**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.503±0.034 OUR AVERAGE</b>			
0.500±0.034±0.011	<sup>1,2</sup> AAIJ	12L LHCB	<i>pp</i> 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  $B(J/\psi \rightarrow \mu^+ \mu^-) / B(\psi(2S) \rightarrow \mu^+ \mu^-) = B(J/\psi \rightarrow e^+ e^-) / B(\psi(2S) \rightarrow e^+ e^-) = 7.69 \pm 0.19$ .

**$\Gamma(\psi(2S)K^0)/\Gamma_{\text{total}}$   $\Gamma_{94}/\Gamma$**

<u>VALUE (units 10<sup>-5</sup>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.9±0.5±0.2</b>	<sup>1</sup> TUMASYAN	22AI CMS	<i>pp</i> at 13 TeV

<sup>1</sup> TUMASYAN 22AI reports  $[\Gamma(B_S^0 \rightarrow \psi(2S)K^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \psi(2S)K^0)] = (3.33 \pm 0.69 \pm 0.11 \pm 0.34) \times 10^{-2}$  which we multiply by our best value  $B(B^0 \rightarrow \psi(2S)K^0) = (5.8 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\psi(2S)K^-\pi^+)/\Gamma_{\text{total}}$   $\Gamma_{95}/\Gamma$

<u>VALUE (units <math>10^{-5}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>3.12 \pm 0.30 \pm 0.21</math></b>	<sup>1</sup> AAIJ	15U LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 15U reports  $[\Gamma(B_s^0 \rightarrow \psi(2S)K^-\pi^+)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow \psi(2S)K^+\pi^-)] = (5.38 \pm 0.36 \pm 0.22 \pm 0.31) \times 10^{-2}$  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.

$\Gamma(\psi(2S)\bar{K}^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{96}/\Gamma$

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

$\Gamma(\chi_{c1}\phi)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{97}/\Gamma_{57}$

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<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  $B(\chi_{c1} \rightarrow J/\psi\gamma) = (34.4 \pm 1.5)\%$ .

$\Gamma(\chi_{c2}K^+K^-)/\Gamma(\chi_{c1}K^+K^-)$   $\Gamma_{99}/\Gamma_{98}$

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>17.1 \pm 3.1 \pm 1.0</math></b>	<sup>1</sup> AAIJ	18AC LHCB	$pp$ at 7, 8, 13 TeV

<sup>1</sup> Measures the ratio for  $\pm 15$  MeV window around  $\phi$  mass.

$\Gamma(\chi_{c1}(3872)\phi)/\Gamma(\psi(2S)\phi)$   $\Gamma_{100}/\Gamma_{93}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.21 \pm 0.07</math> OUR AVERAGE</b>			
$0.22 \pm 0.02 \pm 0.07$	<sup>1</sup> AAIJ	21C LHCB	$pp$ at 7, 8, 13 TeV
$0.20 \pm 0.03 \pm 0.07$	<sup>2</sup> SIRUNYAN	20BB CMS	$pp$ at 13 TeV

<sup>1</sup> AAIJ 21C reports  $[\Gamma(B_s^0 \rightarrow \chi_{c1}(3872)\phi)/\Gamma(B_s^0 \rightarrow \psi(2S)\phi)] \times [B(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi(1S))] / [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)] = (2.42 \pm 0.23 \pm 0.07) \times 10^{-2}$  which we multiply or divide by our best values  $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi(1S)) = (3.8 \pm 1.2) \times 10^{-2}$ ,  $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.68 \pm 0.30) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup> SIRUNYAN 20BB reports  $[\Gamma(B_s^0 \rightarrow \chi_{c1}(3872)\phi)/\Gamma(B_s^0 \rightarrow \psi(2S)\phi)] \times [B(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi(1S))] / [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)] = (2.21 \pm 0.29 \pm 0.17) \times 10^{-2}$  which we multiply or divide by our best values  $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi(1S)) = (3.8 \pm 1.2) \times 10^{-2}$ ,  $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.68 \pm 0.30) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.



$\Gamma(J/\psi K^*(892)^0 \bar{K}^*(892)^0) / \Gamma(\psi(2S)\phi)$   $\Gamma_{83}/\Gamma_{93}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.209 ± 0.006 ± 0.003</b>	<sup>1</sup> AAIJ	21C LHCb	<i>pp</i> at 7, 8, 13 TeV

<sup>1</sup> AAIJ 21C reports  $\Gamma(B_s^0 \rightarrow J/\psi K^*(892)^0 \bar{K}^*(892)^0) / \Gamma(B_s^0 \rightarrow \psi(2S)\phi) B^2(K^{*0} \rightarrow K^+ \pi^-) / B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) / B(\phi \rightarrow K^+ K^-) = 1.22 \pm 0.03 \pm 0.04$  which we adjust with PDG 20 values of  $B(K^{*0} \rightarrow K^+ \pi^-) = (99.902 \pm 0.009) \times 10^{-2}$ ,  $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (34.68 \pm 0.30) \times 10^{-2}$ , and  $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ . The first uncertainty is the total experiment's one and the second is due to the adjustment branching fractions.

$\Gamma(\chi_{c1}(3872)(K^+ K^-)_{non-\phi}) / \Gamma(\chi_{c1}(3872)\phi)$   $\Gamma_{101}/\Gamma_{100}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.77 ± 0.17 ± 0.01</b>	<sup>1</sup> AAIJ	21C LHCb	<i>pp</i> at 7, 8, 13 TeV

<sup>1</sup> AAIJ 21C reports  $[\Gamma(B_s^0 \rightarrow \chi_{c1}(3872)(K^+ K^-)_{non-\phi}) / \Gamma(B_s^0 \rightarrow \chi_{c1}(3872)\phi)] / [B(\phi(1020) \rightarrow K^+ K^-)] = 1.57 \pm 0.32 \pm 0.12$  which we multiply by our best value  $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^+ \pi^-) / \Gamma_{total}$   $\Gamma_{102}/\Gamma$

VALUE (units $10^{-7}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>7.0 ± 1.0 OUR AVERAGE</b>				
7.3 ± 0.9 ± 0.7		<sup>1</sup> AAIJ	17G LHCb	<i>pp</i> at 7 and 8 TeV
6.4 ± 1.8 ± 0.6		<sup>2</sup> AALTONEN	12L CDF	<i>p</i> $\bar{p}$ at 1.96 TeV

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

10.4 <sup>+2.4</sup> <sub>-2.1</sub> ± 1.0		<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  $[\Gamma(B_s^0 \rightarrow \pi^+ \pi^-) / \Gamma_{total}] / [B(B^0 \rightarrow K^+ \pi^-)] \times [\Gamma(\bar{b} \rightarrow B_s^0) / \Gamma(\bar{b} \rightarrow B^0)] = (9.15 \pm 0.71 \pm 0.83) \times 10^{-3}$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0) / \Gamma(\bar{b} \rightarrow B^0) = 0.246 \pm 0.023$ . 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  $[\Gamma(B_s^0 \rightarrow \pi^+ \pi^-) / \Gamma_{total}] / [B(B^0 \rightarrow K^+ \pi^-)] \times [\Gamma(\bar{b} \rightarrow B_s^0) / \Gamma(\bar{b} \rightarrow B^0)] = 0.008 \pm 0.002 \pm 0.001$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0) / \Gamma(\bar{b} \rightarrow B^0) = 0.246 \pm 0.023$ . 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  $[\Gamma(B_s^0 \rightarrow \pi^+ \pi^-) / \Gamma_{total}] / [B(B^0 \rightarrow \pi^+ \pi^-)] \times [\Gamma(\bar{b} \rightarrow B_s^0) / \Gamma(\bar{b} \rightarrow B^0)] = 0.050^{+0.011}_{-0.009} \pm 0.004$  which we multiply or divide by our best values  $B(B^0 \rightarrow \pi^+ \pi^-) = (5.12 \pm 0.19) \times 10^{-6}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0) / \Gamma(\bar{b} \rightarrow B^0) = 0.246 \pm 0.023$ . 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.

$\Gamma(\pi^0 \pi^0) / \Gamma_{\text{total}}$   $\Gamma_{103} / \Gamma$

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

$\Gamma(\eta \pi^0) / \Gamma_{\text{total}}$   $\Gamma_{104} / \Gamma$

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

$\Gamma(\eta \eta) / \Gamma_{\text{total}}$   $\Gamma_{105} / \Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.43 \times 10^{-4}$	90	BHUYAN	22 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$

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

$< 1.5 \times 10^{-3}$	90	<sup>1</sup> ACCIARRI	95H L3	$e^+ e^- \rightarrow Z$
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<sup>1</sup> ACCIARRI 95H assumes  $f_{B^0} = 39.5 \pm 4.0$  and  $f_{B_s} = 12.0 \pm 3.0\%$ .

$\Gamma(\rho^0 \rho^0) / \Gamma_{\text{total}}$   $\Gamma_{106} / \Gamma$

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

$\Gamma(\eta' K_S^0) / \Gamma_{\text{total}}$   $\Gamma_{107} / \Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 8.16 \times 10^{-6}$	90	<sup>1</sup> PANG	22 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$

<sup>1</sup> Uses  $\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}$  decays and assumes  $B(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (20.1 \pm 3.1)\%$ .

$\Gamma(\eta' \eta) / \Gamma_{\text{total}}$   $\Gamma_{108} / \Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 6.5 \times 10^{-5}$	90	<sup>1</sup> NISAR	21 BELL	$e^+ e^- \rightarrow \Upsilon(5S)$

<sup>1</sup> Uses  $\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*$  decays and assumes  $B(\Upsilon(10860) \rightarrow B_s^{(*)} \bar{B}_s^{(*)}) = (20.1 \pm 3.1)\%$ .

$\Gamma(\eta' \eta')/\Gamma_{\text{total}}$   $\Gamma_{109}/\Gamma$

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>3.3 \pm 0.7 \pm 0.1</math></b>		<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  $B(B^+ \rightarrow \eta' K^+) = (7.04 \pm 0.25) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta' \phi)/\Gamma_{\text{total}}$   $\Gamma_{110}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 0.82 \times 10^{-6}</math></b>	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  $f_s/f_u$ .

$\Gamma(\eta' X_{S\bar{S}})/\Gamma_{\text{total}}$   $\Gamma_{55}/\Gamma$

VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.4$	90	<sup>1</sup> DUBEY	21 BELL	$e^+ e^- \rightarrow \Upsilon(4S)$

<sup>1</sup> DUBEY 21 result is for  $m(X_{S\bar{S}}) < 2.85 \text{ GeV}/c^2$ .

$\Gamma(\phi f_0(980), f_0(980) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{111}/\Gamma$

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

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

$\Gamma(\phi f_2(1270), f_2(1270) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{112}/\Gamma$

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

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

$\Gamma(\phi \rho^0)/\Gamma_{\text{total}}$   $\Gamma_{113}/\Gamma$

VALUE (units $10^{-7}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>2.7 \pm 0.7 \pm 0.3</math></b>		<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	$e^+ e^- \rightarrow Z$
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<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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

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

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

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

$\Gamma(\phi\phi)/\Gamma_{\text{total}}$   $\Gamma_{115}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**18.5±1.4 OUR FIT**

**18.5±1.4±1.0**

1 AAIJ	15AS LHCb	$pp$ at 7, 8 TeV		
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$14^{+6}_{-5} \pm 6$	2 ACOSTA	05J CDF	Repl. by AALTONEN 11AN	
$<1183$	90	3 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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

$\Gamma(\phi\phi)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{115}/\Gamma_{57}$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
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**1.77±0.14 OUR FIT**

**1.78±0.14±0.20**

AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV	
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$\Gamma(\phi\phi\phi)/\Gamma(\phi\phi)$   $\Gamma_{116}/\Gamma_{115}$

VALUE	DOCUMENT ID	TECN	COMMENT
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**0.117±0.030±0.015**

AAIJ	17BB LHCb	$pp$ at 7, 8 TeV	
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$\Gamma(\pi^+K^-)/\Gamma_{\text{total}}$   $\Gamma_{117}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**5.8±0.7 OUR AVERAGE**

$5.9 \pm 0.7 \pm 0.6$

1 AAIJ	12AR LHCb	$pp$ at 7 TeV		
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$5.7 \pm 1.0 \pm 0.5$

2 AALTONEN	09C CDF	$p\bar{p}$ at 1.96 TeV		
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• • • We do not use the following data for averages, fits, limits, etc. • • •

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

<sup>1</sup> AAIJ 12AR reports  $[\Gamma(B_s^0 \rightarrow \pi^+K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^+\pi^-)] \times [\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0)] = 0.074 \pm 0.006 \pm 0.006$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+\pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0)/\Gamma(\bar{b} \rightarrow B^0) = 0.246 \pm 0.023$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup> AALTONEN 09C reports  $[\Gamma(B_s^0 \rightarrow \pi^+K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^+\pi^-)] \times [B(\bar{b} \rightarrow B_s^0) / B(\bar{b} \rightarrow B^0)] = 0.071 \pm 0.010 \pm 0.007$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+\pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $B(\bar{b} \rightarrow B_s^0) = (10.0 \pm 0.8) \times 10^{-2}$ ,  $B(\bar{b} \rightarrow B^0) = (40.8 \pm 0.7) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

- <sup>3</sup> Uses  $\Upsilon(10860) \rightarrow B_s^* \bar{B}_s^*$  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  $B^0_d$  ( $B_s^0$ ) fraction 39.5% (12%).

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

$\Gamma_{118} / \Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>26.6 ± 2.2 OUR AVERAGE</b>				
25.2 ± 1.7 ± 2.4		<sup>1</sup> AAIJ	12AR LHCb	$p\bar{p}$ at 7 TeV
27.6 ± 2.3 ± 2.7		<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		<sup>4</sup> ABULENCIA,A 06D	CDF	Repl. by AALTONEN 11N
<283	90	<sup>5</sup> ABE	00C SLD	$e^+ e^- \rightarrow Z$
< 59	90	<sup>6</sup> BUSKULIC	96V ALEP	$e^+ e^- \rightarrow Z$
<140	90	<sup>7</sup> AKERS	94L OPAL	$e^+ e^- \rightarrow Z$

- <sup>1</sup> AAIJ 12AR reports  $[\Gamma(B_s^0 \rightarrow K^+ K^-) / \Gamma_{\text{total}}] / [B(B^0 \rightarrow K^+ \pi^-)] \times [\Gamma(\bar{b} \rightarrow B_s^0) / \Gamma(\bar{b} \rightarrow B^0)] = 0.316 \pm 0.009 \pm 0.019$  which we multiply or divide by our best values  $B(B^0 \rightarrow K^+ \pi^-) = (1.96 \pm 0.05) \times 10^{-5}$ ,  $\Gamma(\bar{b} \rightarrow B_s^0) / \Gamma(\bar{b} \rightarrow B^0) = 0.246 \pm 0.023$ . 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  $1/2 f_s/f_d = 0.1230 \pm 0.0115$ . 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  $B^0_d$  ( $B_s^0$ ) fraction 39.5% (12%).

$\Gamma(K^0 \bar{K}^0)/\Gamma_{\text{total}}$   $\Gamma_{119}/\Gamma$

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**1.76 ± 0.31 OUR AVERAGE**

1.68 ± 0.34 <sup>+0.16</sup> <sub>-0.15</sub>		1 AAIJ	20F	LHCB $pp$ at 7, 8, 13 TeV
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1.96 <sup>+0.58</sup> <sub>-0.51</sub> ± 0.10 ± 0.20		2 PAL	16	BELL $e^+e^- \rightarrow \Upsilon(5S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.6	90	3 PENG	10	BELL Repl. by PAL 16
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<sup>1</sup> AAIJ 20F reports  $[\Gamma(B_S^0 \rightarrow K^0 \bar{K}^0)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow K^0 \phi)] = 2.3 \pm 0.4 \pm 0.2 \pm 0.1$  which we multiply by our best value  $B(B^0 \rightarrow K^0 \phi) = (7.3 \pm 0.7) \times 10^{-6}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> 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>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  $\Gamma(\Upsilon(10860) \rightarrow B_S^* \bar{B}_S^*) / \Gamma(\Upsilon(10860) \rightarrow B_S^{(*)} \bar{B}_S^{(*)}) = (90.1^{+3.8}_{-4.0})\%$ .

$\Gamma(K^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{120}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
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**9.5 ± 2.1 ± 0.3**

1,2 AAIJ	17BP	LHCB	$pp$ at 7, 8 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

14 ± 4 ± 1	3 AAIJ	13BP	LHCB Repl. by AAIJ 17BP
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<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  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.97 \pm 0.18) \times 10^{-5}$ . 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  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.97 \pm 0.18) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^0 K^\pm \pi^\mp)/\Gamma_{\text{total}}$   $\Gamma_{121}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
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**8.4 ± 0.8 ± 0.3**

1,2 AAIJ	17BP	LHCB	$pp$ at 7, 8 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

7.4 ± 0.9 ± 0.3	3 AAIJ	13BP	LHCB Repl. by AAIJ 17BP
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<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  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.97 \pm 0.18) \times 10^{-5}$ . 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  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.97 \pm 0.18) \times 10^{-5}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^*(892)^-\pi^+)/\Gamma_{\text{total}}$   $\Gamma_{122}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.9±1.0±0.2</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  $B(B^0 \rightarrow K^*(892)^+\pi^-) = (7.5 \pm 0.4) \times 10^{-6}$ . 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  $f_s/f_d = 0.259 \pm 0.015$ .

$\Gamma(K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}$   $\Gamma_{123}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.86±0.12±0.45</b>	1,2 AAIJ	19K LHCB	$pp$ at 7, 8 TeV

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

$1.12 \pm 0.21^{+0.07}_{-0.06}$	3,4 AAIJ	14BMLHCB	Repl. by AAIJ 19K
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<sup>1</sup> AAIJ 19K reports  $(18.6 \pm 1.2 \pm 0.8 \pm 4.0 \pm 2.0) \times 10^{-6}$  as the measured value. We have combined in quadrature all systematic uncertainties into a single one.

<sup>2</sup> Measured in Dalitz plot analysis of  $B_S^0 \rightarrow K_S^0 K^\pm \pi^\mp$  decays.

<sup>3</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  $B(B^0 \rightarrow K^*(892)^+\pi^-) = (7.5 \pm 0.4) \times 10^{-6}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>4</sup> Uses  $f_s/f_d = 0.259 \pm 0.015$ .

$\Gamma(K_0^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}$   $\Gamma_{124}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>3.13±0.23±2.53</b>	1,2 AAIJ	19K LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 19K reports  $(31.3 \pm 2.3 \pm 0.7 \pm 25.1 \pm 3.3) \times 10^{-6}$  as the measured value. We have combined in quadrature all systematic uncertainties into a single one.

<sup>2</sup> Measured in Dalitz plot analysis of  $B_S^0 \rightarrow K_S^0 K^\pm \pi^\mp$  decays.

$\Gamma(K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}$   $\Gamma_{125}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.03±0.25±1.64</b>	1,2 AAIJ	19K LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 19K reports  $(10.3 \pm 2.5 \pm 1.1 \pm 16.3 \pm 1.1) \times 10^{-6}$  as the measured value. We have combined in quadrature all systematic uncertainties into a single one.

<sup>2</sup> Measured in Dalitz plot analysis of  $B_S^0 \rightarrow K_S^0 K^\pm \pi^\mp$  decays.

$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{126}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.98±0.28±0.50</b>	1,2 AAIJ	19K LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 19K reports  $(19.8 \pm 2.8 \pm 1.2 \pm 4.4 \pm 2.1) \times 10^{-6}$  as the measured value. We have combined in quadrature all systematic uncertainties into a single one.

<sup>2</sup> Measured in Dalitz plot analysis of  $B_S^0 \rightarrow K_S^0 K^\pm \pi^\mp$  decays.

$\Gamma(K_0^*(1430)\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{127}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>3.30 \pm 0.25 \pm 0.98</math></b>	1,2 AAIJ	19K	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 19K reports  $(33.0 \pm 2.5 \pm 0.9 \pm 9.1 \pm 3.5) \times 10^{-6}$  as the measured value. We have combined in quadrature all systematic uncertainties into a single one.

<sup>2</sup> Measured in Dalitz plot analysis of  $B_S^0 \rightarrow K_S^0 K^\pm \pi^\mp$  decays.

$\Gamma(K_2^*(1430)^0\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{128}/\Gamma$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>1.68 \pm 0.45 \pm 2.13</math></b>	1,2 AAIJ	19K	LHCB $pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 19K reports  $(16.8 \pm 4.5 \pm 1.7 \pm 21.2 \pm 1.8) \times 10^{-6}$  as the measured value. We have combined in quadrature all systematic uncertainties into a single one.

<sup>2</sup> Measured in Dalitz plot analysis of  $B_S^0 \rightarrow K_S^0 K^\pm \pi^\mp$  decays.

$\Gamma(K_S^0\bar{K}^*(892)^0 + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{129}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>16.4 \pm 3.4 \pm 2.3</math></b>	1 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  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.96 \pm 0.2) \times 10^{-5}$ .

$\Gamma(K^0 K^+ K^-)/\Gamma_{\text{total}}$   $\Gamma_{130}/\Gamma$

VALUE (units $10^{-7}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>12.9 \pm 6.5 \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                      <sup>4</sup> 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  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = (4.97 \pm 0.18) \times 10^{-5}$ . 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  $B(B^0 \rightarrow K^0 \pi^+ \pi^-) = 4.97 \times 10^{-5}$ .

$\Gamma(\bar{K}^*(892)^0 \rho^0)/\Gamma_{\text{total}}$   $\Gamma_{131}/\Gamma$

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



$\Gamma(\bar{K}^*(892)^0 K^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{132}/\Gamma$

VALUE (units $10^{-5}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**1.11 ± 0.26 ± 0.06** 1 AAIJ 15AF LHCB  $pp$  at 7 TeV

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

2.81 ± 0.46 ± 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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

$\Gamma(\phi K^*(892)^0)/\Gamma_{\text{total}}$   $\Gamma_{136}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**1.14 ± 0.29 ± 0.06** 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  $f_{B_s} = (10.5^{+1.8}_{-2.2})\%$ .

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$   $\Gamma_{137}/\Gamma$

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

VALUE (units $10^{-8}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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< **1.5** 90 1 AAIJ 17BJ LHCB  $pp$  at 7 and 8 TeV

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

2.84<sup>+2.03+0.85</sup><sub>-1.68-0.18</sub> 2 AAIJ 13BQ LHCB Repl. by AAIJ 17BJ

<5900 90 3 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.

$\Gamma(\rho\bar{p}K^+K^-)/\Gamma_{\text{total}}$   $\Gamma_{138}/\Gamma$

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

<sup>1</sup> AAIJ 17BD reports  $[\Gamma(B_s^0 \rightarrow \rho\bar{p}K^+K^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)K^*(892)^0)] / [B(J/\psi(1S) \rightarrow \rho\bar{p})] / [B(K^*(892) \rightarrow (K\pi)^\pm)] = 1.67 \pm 0.12 \pm 0.11$  which we multiply by our best values  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.27 \pm 0.05) \times 10^{-3}$ ,  $B(J/\psi(1S) \rightarrow \rho\bar{p}) = (2.120 \pm 0.029) \times 10^{-3}$ ,  $B(K^*(892) \rightarrow (K\pi)^\pm) = (99.902 \pm 0.009) \times 10^{-2}$ . 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.

$\Gamma(\rho\bar{p}K^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{139}/\Gamma$

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

<sup>1</sup> AAIJ 17BD reports  $[\Gamma(B_s^0 \rightarrow \rho\bar{p}K^+\pi^-)/\Gamma_{\text{total}}] / [B(B^0 \rightarrow J/\psi(1S)K^*(892)^0)] / [B(J/\psi(1S) \rightarrow \rho\bar{p})] / [B(K^*(892) \rightarrow (K\pi)^\pm)] = 0.52 \pm 0.08 \pm 0.05$  which we multiply by our best values  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.27 \pm 0.05) \times 10^{-3}$ ,  $B(J/\psi(1S) \rightarrow \rho\bar{p}) = (2.120 \pm 0.029) \times 10^{-3}$ ,  $B(K^*(892) \rightarrow (K\pi)^\pm) = (99.902 \pm 0.009) \times 10^{-2}$ . 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.

$\Gamma(\rho\bar{p}K^+\pi^-)/\Gamma(\rho\bar{p}K^+K^-)$   $\Gamma_{139}/\Gamma_{138}$

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  $B(B_s^0 \rightarrow \rho\bar{p}K^+\pi^-) / B(B^0 \rightarrow \rho\bar{p}K^+K^-) = 0.22 \pm 0.04 \pm 0.02 \pm 0.01$ , 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  $f_s/f_d = 0.259 \pm 0.015$ .

$\Gamma(\rho\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{140}/\Gamma$

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  $B(B^0 \rightarrow J/\psi(1S)K^*(892)^0) = (1.27 \pm 0.05) \times 10^{-3}$ ,  $B(J/\psi(1S) \rightarrow \rho\bar{p}) = (2.120 \pm 0.029) \times 10^{-3}$ ,  $B(K^*(892) \rightarrow (K\pi)^\pm) = (99.902 \pm 0.009) \times 10^{-2}$ . 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.

$\Gamma(\rho\bar{\Lambda}K^- + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{141}/\Gamma$

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  $f_s/f_d = 0.259 \pm 0.015$ .

$\Gamma(\Lambda_c^- \Lambda \pi^+)/\Gamma_{\text{total}}$   $\Gamma_{142}/\Gamma$

VALUE (units $10^{-4}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>3.6 \pm 1.1 \pm 1.2</math></b>		<sup>1</sup> 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  $B_c$  events.

$\Gamma(\Lambda_c^- \Lambda_c^+)/\Gamma_{\text{total}}$   $\Gamma_{143}/\Gamma$

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

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

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{144}/\Gamma$

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

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 3.1</math></b>	90	<sup>1</sup> DUTTA	15	BELL $e^+ e^- \rightarrow \Upsilon(5S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$< 8.7$	90	<sup>2</sup> WICHT	08A	BELL Repl. by DUTTA 15
$< 53$	90	DRUTSKOY	07A	BELL Repl. by WICHT 08A
$< 148$	90	<sup>3</sup> 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  $f_{B_s} = (12.0 \pm 3.0)\%$ .

$\Gamma(\phi\gamma)/\Gamma_{\text{total}}$   $\Gamma_{145}/\Gamma$

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>34 \pm 4</math> OUR AVERAGE</b>				
$36 \pm 5 \pm 7$		<sup>1</sup> DUTTA	15	BELL $e^+ e^- \rightarrow \Upsilon(5S)$
$33.8 \pm 3.4 \pm 2.0$		<sup>2</sup> AAIJ	13	LHCB $pp$ at 7 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$39 \pm 5$		<sup>3</sup> AAIJ	12AE	LHCB Repl. by AAIJ 13
$57^{+18}_{-15} \pm 12_{-11}$		<sup>4</sup> 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	<sup>5</sup> 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  $f_{B_s} = 0.12$ .

$\Gamma(\mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{146}/\Gamma$   
 Test for  $\Delta B = 1$  weak neutral current.

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

**3.01 ± 0.35 OUR AVERAGE**

3.09 <sup>+0.46</sup> <sub>-0.43</sub> ± 0.15 <sub>-0.11</sub>		AAIJ	22	LHCB	$\rho\rho$ at 7, 8, 13 TeV
2.9 ± 0.6 ± 0.4	1	SIRUNYAN	20AG	CMS	$\rho\rho$ at 7, 8, 13 TeV
2.8 <sup>+0.8</sup> <sub>-0.7</sub>	2	AABOUD	19L	ATLS	$\rho\rho$ at 7, 8, 13 TeV
13 <sup>+9</sup> <sub>-7</sub>	3	AALTONEN	13F	CDF	$\rho\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.0 ± 0.6 <sup>+0.3</sup> <sub>-0.2</sub>		AAIJ	17AI	LHCB	Repl. by AAIJ 22
0.9 <sup>+1.1</sup> <sub>-0.8</sub>	4	AABOUD	16L	ATLS	Repl. by AABOUD 19L
2.8 <sup>+0.7</sup> <sub>-0.6</sub>	5	KHACHATRYAN 15BE	LHC		$\rho\rho$ at 7, 8 TeV
3.2 <sup>+1.4</sup> <sub>-1.2</sub> ± 0.5 <sub>-0.3</sub>	6	AAIJ	13B	LHCB	Repl. by AAIJ 13BA
2.9 <sup>+1.1</sup> <sub>-1.0</sub> ± 0.3 <sub>-0.1</sub>	7	AAIJ	13BA	LHCB	Repl. by KHACHATRYAN 15BE
<12	90	8 ABAZOV	13C	D0	$\rho\bar{p}$ at 1.96 TeV
3.0 <sup>+1.0</sup> <sub>-0.9</sub>		9 CHATRCHYAN 13AW	CMS		Repl. by SIRUNYAN 20AG
<19	90	10 AAD	12AE	ATLS	$\rho\rho$ at 7 TeV
<12	90	11 AAIJ	12A	LHCB	Repl. by AAIJ 12W
< 3.8	90	12 AAIJ	12W	LHCB	Repl. by AAIJ 13B
< 6.4	90	13 CHATRCHYAN 12A	CMS		$\rho\rho$ at 7 TeV
<43	90	14 AAIJ	11B	LHCB	Repl. by AAIJ 12A
<35	90	15 AALTONEN	11AG	CDF	$\rho\bar{p}$ at 1.96 TeV
<16	90	16 CHATRCHYAN 11T	CMS		Repl. by CHATRCHYAN 12A
<42	90	17 ABAZOV	10S	D0	$\rho\bar{p}$ at 1.96 TeV

<sup>1</sup> Uses normalization mode  $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.03) \times 10^{-3}$  and  $B$  production ratio  $f(b \rightarrow B_s^0)/f(b \rightarrow B^+) = 0.252 \pm 0.012 \pm 0.015$ .

<sup>2</sup> Uses normalization mode  $B(B^+ \rightarrow J/\psi K^+) = (1.010 \pm 0.029) \times 10^{-3}$  and  $B$  production ratio  $f(b \rightarrow B_s^0)/f(b \rightarrow B^+) = 0.256 \pm 0.013$ .

<sup>3</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>4</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>5</sup> Determined from the joint fit to CMS and LHCb data. Uncertainty includes both statistical and systematic component.

<sup>6</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>7</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>8</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>9</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>10</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>11</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>12</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>13</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>14</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>15</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>16</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>17</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.

**$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$**   **$\Gamma_{147}/\Gamma$**

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt;9.4 \times 10^{-9}</math></b>	90	<sup>1</sup> AAIJ	20W LHCB	$pp$ at 7, 8, 13 TeV
$<2.8 \times 10^{-7}$	90	AALTONEN	09P CDF	$p\bar{p}$ at 1.96 TeV
$<5.4 \times 10^{-5}$	90	<sup>2</sup> ACCIARRI	97B L3	$e^+ e^- \rightarrow Z$

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

<sup>1</sup> Assumes no contribution from  $B^0 \rightarrow e^+ e^-$  decays.

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

**$\Gamma(\tau^+ \tau^-)/\Gamma_{\text{total}}$**   **$\Gamma_{148}/\Gamma$**

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

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

**$\Gamma(\mu^+ \mu^- \gamma)/\Gamma_{\text{total}}$**   **$\Gamma_{149}/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>&lt;2.0 \times 10^{-9}</math></b>	<sup>1</sup> AAIJ	22 LHCB	$pp$ at 7, 8, 13 TeV

<sup>1</sup> The exclusion is limited to the range  $m_{\mu\mu} > 4.9 \text{ GeV}/c^2$ .

**$\Gamma(\mu^+ \mu^- \mu^+ \mu^-)/\Gamma_{\text{total}}$**   **$\Gamma_{150}/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt;8.6 \times 10^{-10}</math></b>	95	AAIJ	22Q LHCB	$pp$ at 7, 8, 13 TeV

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

$<2.5 \times 10^{-9}$	95	AAIJ	17N LHCB	$pp$ at 7, 8 TeV
$<1.6 \times 10^{-8}$	95	<sup>1</sup> AAIJ	13AW LHCB	Repl. by AAIJ 17N

<sup>1</sup> Also reports a limit of  $< 1.2 \times 10^{-8}$  at 90% CL.

$\Gamma(SP, S \rightarrow \mu^+ \mu^-, P \rightarrow \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{151}/\Gamma$

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

$\Gamma(aa, a \rightarrow \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{152}/\Gamma$

Here particle  $a$  is a scalar with a mass of 1 GeV/c<sup>2</sup>.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.8 \times 10^{-10}$	95	AAIJ	22Q LHCb	$pp$ at 7, 8, 13 TeV

$\Gamma(\phi(1020)\mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{153}/\Gamma$

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

VALUE (units $10^{-7}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$<32$	90	<sup>1</sup> ABAZOV	06G D0	$p\bar{p}$ at 1.96 TeV
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$<4.7 \times 10^2$	90	ACOSTA	02D CDF	$p\bar{p}$ at 1.8 TeV
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<sup>1</sup>Uses  $B(B_S^0 \rightarrow J/\psi\phi) = 9.3 \times 10^{-4}$ .

$\Gamma(\phi(1020)\mu^+ \mu^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{153}/\Gamma_{57}$

VALUE (units $10^{-3}$ )	CL%	DOCUMENT ID	TECN	COMMENT
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**0.806 ± 0.026 OUR AVERAGE**

$0.800 \pm 0.021 \pm 0.016$		AAIJ	21AG LHCb	$pp$ at 7, 8, 13 TeV
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$1.13 \pm 0.19 \pm 0.07$		AALTONEN	11AI CDF	$p\bar{p}$ at 1.96 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.741^{+0.042}_{-0.040} \pm 0.029$		AAIJ	15AQ LHCb	Repl. by AAIJ 21AG
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$0.674^{+0.061}_{-0.056} \pm 0.016$		AAIJ	13X LHCb	Repl. by AAIJ 15AQ
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$1.11 \pm 0.25 \pm 0.09$		AALTONEN	11L CDF	Repl. by AALTONEN 11AI
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$<2.3$	90	AALTONEN	09B CDF	Repl. by AALTONEN 11L
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$\Gamma(\bar{K}^*(892)^0 \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{155}/\Gamma$

VALUE (units $10^{-8}$ )	DOCUMENT ID	TECN	COMMENT
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<b>2.9 ± 1.0 ± 0.4</b>	<sup>1</sup> AAIJ	18AB LHCb	$pp$ at 7, 8, 13 TeV
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<sup>1</sup>Normalizes to  $B(B^0 \rightarrow J/\psi K^{*0}) = 1.19 \pm 0.01 \pm 0.08\%$  and  $B(J/\psi \rightarrow \mu^+ \mu^-) = 5.96 \pm 0.03\%$ , and uses  $f_S/f_D = 0.259 \pm 0.015$ .

$\Gamma(f'_2(1525)\mu^+ \mu^-)/\Gamma(J/\psi(1S)\phi)$   $\Gamma_{154}/\Gamma_{57}$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
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<b>1.55 ± 0.19 ± 0.08</b>	<sup>1</sup> AAIJ	21AG LHCb	$pp$ at 7, 8, 13 TeV
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<sup>1</sup>Measured by combining the  $q^2$  regions [0.1, 0.98], [1.1, 8.0], and [11.0, 12.5] GeV<sup>2</sup>/c<sup>4</sup>.

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_{156}/\Gamma$

VALUE (units $10^{-8}$ )	CL%	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.

$\Gamma(\phi\nu\bar{\nu})/\Gamma_{\text{total}}$   $\Gamma_{157}/\Gamma$

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  $f_{B_s} = 0.12$ .

$\Gamma(e^\pm\mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{158}/\Gamma$

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 5.4 \times 10^{-9}</math></b>	90	<sup>1</sup> AAIJ	18T LHCB	$pp$ at 7, 8 TeV

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

$< 1.1 \times 10^{-8}$	90	<sup>2</sup> AAIJ	13BMLHCB	Repl. by AAIJ 18T
$< 2.0 \times 10^{-7}$	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>3</sup> ACCIARRI	97B L3	$e^+e^- \rightarrow Z$

<sup>1</sup> AAIJ 18T uses normalization modes  $B(B^0 \rightarrow K^+\pi^-) = (19.6 \pm 0.5) \times 10^{-6}$  and  $B(B^+ \rightarrow J/\psi K^+) = (1.026 \pm 0.031) \times 10^{-3}$  with  $B$  production ratio  $f(\bar{b} \rightarrow B_s^0)/f(\bar{b} \rightarrow B_d^0) = 0.259 \pm 0.015$ . The upper limit increases to  $6 \times 10^{-9}$  with the assumption of  $B_L$ -dominated decay amplitude.

<sup>2</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>3</sup> ACCIARRI 97B assume PDG 96 production fractions for  $B^+$ ,  $B^0$ ,  $B_s$ , and  $\Lambda_b$ .

$\Gamma(\mu^\pm\tau^\mp)/\Gamma_{\text{total}}$   $\Gamma_{159}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 4.2 \times 10^{-5}</math></b>	95	<sup>1</sup> AAIJ	19AK LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Assuming no contribution from  $B^0 \rightarrow \mu^\pm\tau^\mp$ .

## 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  $\phi_\perp$ . In decays involving two tensor mesons, the transverse polarization states are described by parameters  $\Gamma_{\parallel 1}$ ,  $\Gamma_{\parallel 2}$ ,  $\Gamma_{\perp 1}$ ,  $\Gamma_{\perp 2}$  and their relative phases  $\phi_{\parallel 1}$ ,  $\phi_{\parallel 2}$ ,  $\phi_{\perp 1}$ ,  $\phi_{\perp 2}$ . See also the review on "Polarization in  $B$  Decays."

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

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

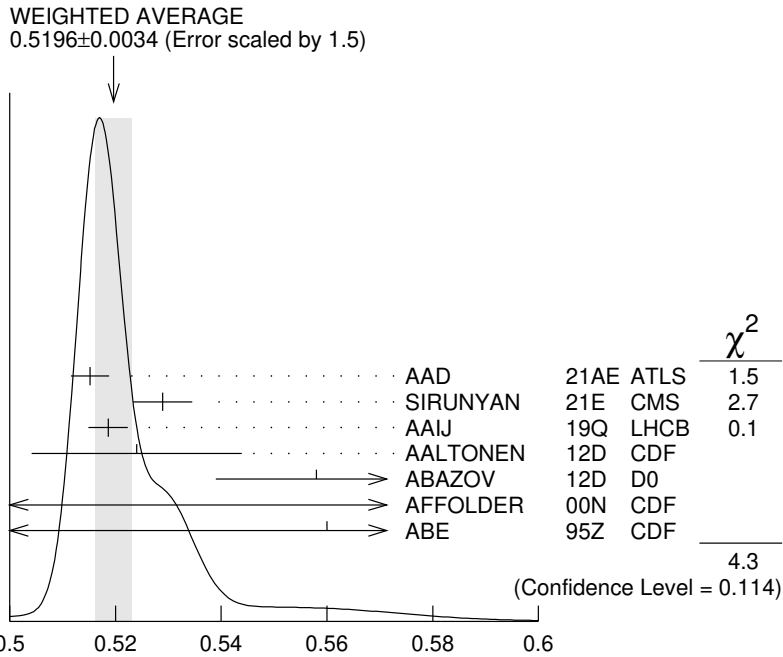
$\Gamma_L/\Gamma$  in  $B_s^0 \rightarrow J/\psi(1S)\phi$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.5196 \pm 0.0034</math> OUR AVERAGE</b>	Error includes scale factor of 1.5. See the ideogram below.		

$0.5152 \pm 0.0012 \pm 0.0034$	1	AAD	21AE	ATLS	$pp$ at 7, 8, 13 TeV
$0.5289 \pm 0.0038 \pm 0.0041$	2	SIRUNYAN	21E	CMS	$pp$ at 8, 13 TeV
$0.5186 \pm 0.0029 \pm 0.0023$		AAIJ	19Q	LHCB	$pp$ at 13 TeV
$0.524 \pm 0.013 \pm 0.015$	2	AALTONEN	12D	CDF	$p\bar{p}$ at 1.96 TeV
$0.558^{+0.017}_{-0.019}$	2,3	ABAZOV	12D	D0	$p\bar{p}$ at 1.96 TeV
$0.61 \pm 0.14 \pm 0.02$	4	AFFOLDER	00N	CDF	$p\bar{p}$ at 1.8 TeV
$0.56 \pm 0.21^{+0.02}_{-0.04}$		ABE	95Z	CDF	$p\bar{p}$ at 1.8 TeV

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

$0.5350 \pm 0.0047 \pm 0.0049$	2	SIRUNYAN	21E	CMS	$pp$ at 13 TeV
$0.522 \pm 0.003 \pm 0.007$	1	AAD	16AP	ATLS	Repl. by AAD 21AE
$0.510 \pm 0.005 \pm 0.011$	2	KHACHATRY...	16S	CMS	$pp$ at 8 TeV
$0.5241 \pm 0.0034 \pm 0.0067$		AAIJ	15I	LHCB	Repl. by AAIJ 19Q
$0.529 \pm 0.006 \pm 0.012$	1	AAD	14U	ATLS	Repl. by AAD 16AP
$0.539 \pm 0.014 \pm 0.016$	2	AAD	12CV	ATLS	Repl. by AAD 14U
$0.555 \pm 0.027 \pm 0.006$	5	ABAZOV	09E	D0	Repl. by ABAZOV 12D
$0.531 \pm 0.020 \pm 0.007$	2	AALTONEN	08J	CDF	Repl. by AALTONEN 12D
$0.62 \pm 0.06 \pm 0.01$		ACOSTA	05	CDF	Repl. by AALTONEN 08J



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

<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
$0.06^{+0.18}_{-0.17} \pm 0.03$	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>0.2222 \pm 0.0027</math> OUR AVERAGE</b>			

$0.2220 \pm 0.0017 \pm 0.0021$  <sup>1</sup> AAD 21AE ATLS  $pp$  at 7, 8, 13 TeV

$0.231 \pm 0.014 \pm 0.015$  <sup>2</sup> AALTONEN 12D CDF  $p\bar{p}$  at 1.96 TeV

$0.231^{+0.024}_{-0.030}$  <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. • • •

$0.227 \pm 0.004 \pm 0.006$  <sup>1</sup> AAD 16AP ATLS Repl. by AAD 21AE

$0.220 \pm 0.008 \pm 0.009$  <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>0.243 \pm 0.004</math> OUR AVERAGE</b>			

$0.2393 \pm 0.0050 \pm 0.0037$  SIRUNYAN 21E CMS  $pp$  at 8, 13 TeV

$0.2456 \pm 0.0040 \pm 0.0019$  AAIJ 19Q LHCb  $pp$  at 13 TeV

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

$0.2337 \pm 0.0063 \pm 0.0045$  SIRUNYAN 21E CMS  $pp$  at 13 TeV

$0.243 \pm 0.008 \pm 0.012$  KHACHATRY...16S CMS  $pp$  at 8 TeV

$0.2504 \pm 0.0049 \pm 0.0036$  AAIJ 15I LHCb Repl. by AAIJ 19Q

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

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
<b><math>3.19 \pm 0.07</math> OUR AVERAGE</b>	Error includes scale factor of 1.3. See the ideogram below.		

$3.36 \pm 0.05 \pm 0.09$  <sup>1</sup> AAD 21AE ATLS  $pp$  at 7, 8, 13 TeV

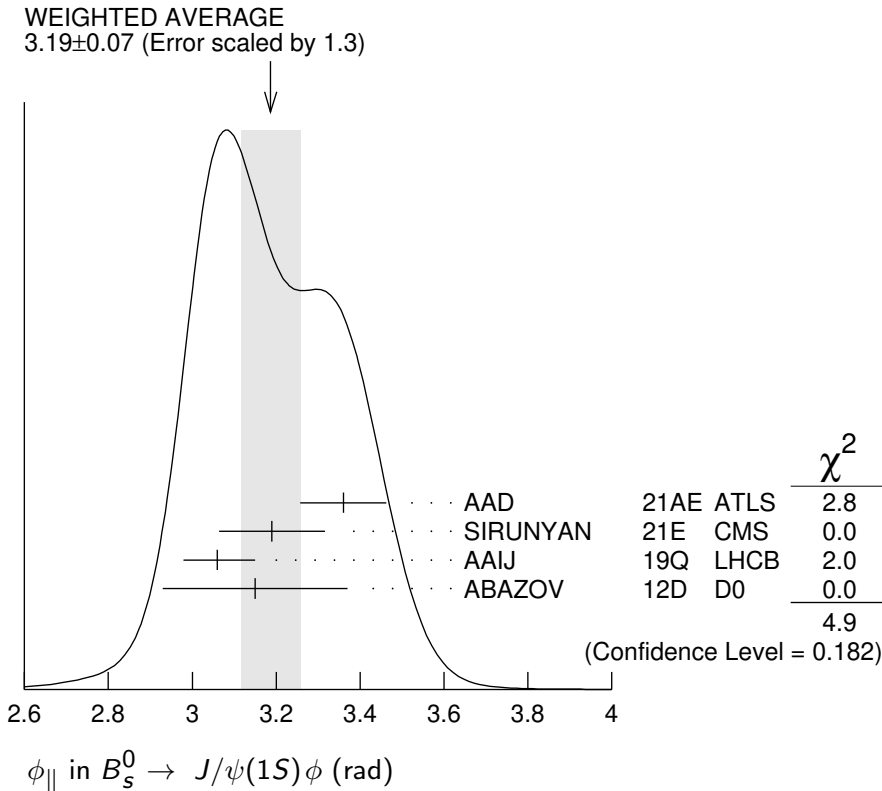
$3.19 \pm 0.12 \pm 0.04$  SIRUNYAN 21E CMS  $pp$  at 8, 13 TeV

$3.06^{+0.08}_{-0.07} \pm 0.04$  AAIJ 19Q LHCb  $pp$  at 13 TeV

$3.15 \pm 0.22$  <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. • • •

$3.18 \pm 0.12 \pm 0.003$	SIRUNYAN	21E	CMS	$pp$ at 13 TeV
$3.15 \pm 0.10 \pm 0.05$	AAD	16AP	ATLS	Repl. by AAD 21AE
$3.48^{+0.07}_{-0.09} \pm 0.68$	KHACHATRY...16S	CMS		$pp$ at 8 TeV
$3.26^{+0.10+0.06}_{-0.17-0.07}$	AAIJ	15I	LHCB	Repl. by AAIJ 19Q
$2.72^{+1.12}_{-0.27} \pm 0.26$	ABAZOV	09E	D0	Repl. by ABAZOV 12D

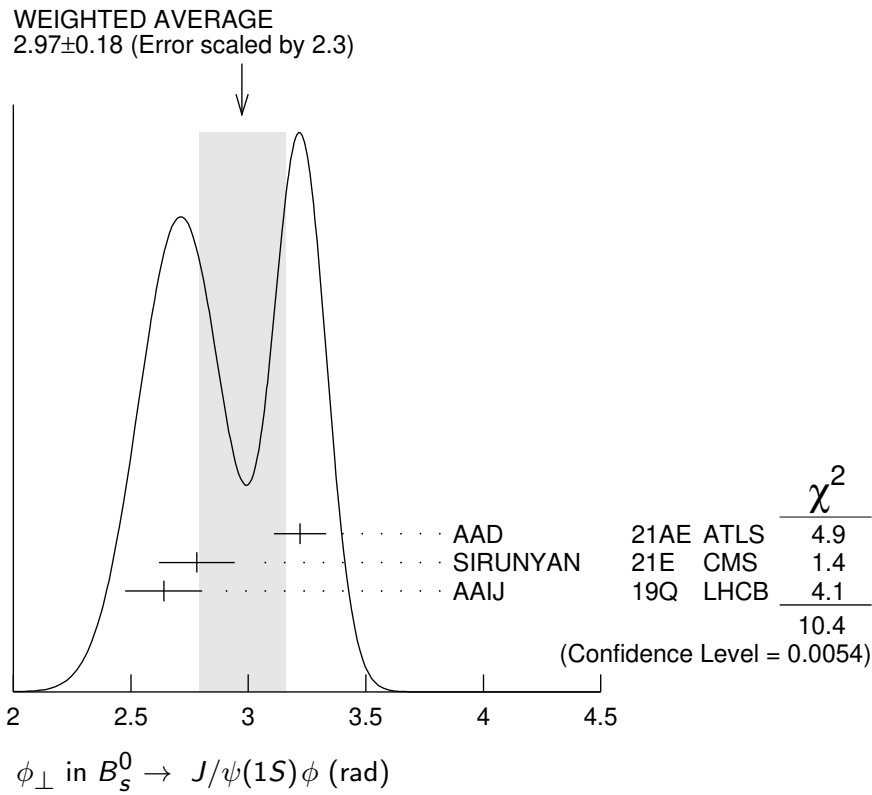


<sup>1</sup> The fit found another solution with  $\phi_{\parallel} = 2.95 \pm 0.05 \pm 0.09$  rad.

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

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

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
<b><math>2.97 \pm 0.18</math> OUR AVERAGE</b>	Error includes scale factor of 2.3. See the ideogram below.		
$3.22 \pm 0.10 \pm 0.05$	<sup>1</sup> AAD	21AE ATLS	$pp$ at 7, 8, 13 TeV
$2.78 \pm 0.15 \pm 0.06$	<sup>2</sup> SIRUNYAN	21E CMS	$pp$ at 8, 13 TeV
$2.64 \pm 0.13 \pm 0.10$	AAIJ	19Q LHCB	$pp$ at 13 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2.77 \pm 0.16 \pm 0.05$	<sup>2</sup> SIRUNYAN	21E CMS	$pp$ at 13 TeV
$4.15 \pm 0.32 \pm 0.16$	<sup>2</sup> AAD	16AP ATLS	Repl. by AAD 21AE
$2.98 \pm 0.36 \pm 0.66$	<sup>2</sup> KHACHATRY...16S	CMS	$pp$ at 8 TeV
$3.08^{+0.14}_{-0.15} \pm 0.06$	AAIJ	15I LHCB	Repl. by AAIJ 19Q
$3.89 \pm 0.47 \pm 0.11$	<sup>2</sup> AAD	14U ATLS	Repl. by AAD 16AP



<sup>1</sup> The fit found another solution with  $\phi_{\perp} = 3.03 \pm 0.05 \pm 0.09$  rad.

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
$0.264^{+0.024}_{-0.023} \pm 0.002$	<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 $B_s^0 \rightarrow \psi(2S)\phi$

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
$3.67^{+0.13}_{-0.18} \pm 0.03$	<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 $B_s^0 \rightarrow \psi(2S)\phi$

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
$3.29^{+0.43}_{-0.39} \pm 0.04$	<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
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<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
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<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>0.378 \pm 0.013</math> OUR AVERAGE</b>			

$0.381 \pm 0.007 \pm 0.012$

AAIJ 19AP LHCB  $pp$  at 7, 8 and 13 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. • • •

$0.364 \pm 0.012 \pm 0.009$

AAIJ 14AE LHCB Repl. by AAIJ 19AP

$0.365 \pm 0.022 \pm 0.012$

AAIJ 12P LHCB Repl. by AAIJ 14AE

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.292 \pm 0.009</math> OUR AVERAGE</b>			

$0.290 \pm 0.008 \pm 0.005$

<sup>1</sup>AAIJ 19AP LHCB  $pp$  at 7, 8 and 13 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. • • •

$0.305 \pm 0.013 \pm 0.005$

AAIJ 14AE LHCB Repl. by AAIJ 19AP

$0.291 \pm 0.024 \pm 0.010$

AAIJ 12P LHCB Repl. by AAIJ 14AE

<sup>1</sup>Note: in the summary of AAIJ 19AP the systematic uncertainty is 0.007. We take the systematic uncertainty as given in Table 5 in the paper.

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

<u>VALUE (rad)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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#### **2.56 ± 0.06 OUR AVERAGE**

2.559 ± 0.045 ± 0.033	AAIJ	19AP LHCB	$p\bar{p}$ at 7, 8 and 13 TeV
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2.71 $^{+0.31}_{-0.36}$ ± 0.22	<sup>1</sup> AALTONEN	11AN CDF	$p\bar{p}$ at 1.96 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.54 ± 0.07 ± 0.09	<sup>2</sup> AAIJ	14AE LHCB	Repl. by AAIJ 19AP
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2.57 ± 0.15 ± 0.06	<sup>3</sup> AAIJ	12P LHCB	Repl. by AAIJ 14AE
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<sup>1</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>2</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>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>
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<b>2.818 ± 0.178 ± 0.073</b>	AAIJ	19AP LHCB	$p\bar{p}$ at 7, 8 and 13 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.67 ± 0.23 ± 0.07	AAIJ	14AE LHCB	Repl. by AAIJ 19AP
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### $\Gamma_{L}/\Gamma$ in $B_s^0 \rightarrow K^{*0}\bar{K}^{*0}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>0.240 ± 0.031 ± 0.025</b>	<sup>1</sup> AAIJ	19L LHCB	$p\bar{p}$ at 7 and 8 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.208 ± 0.032 ± 0.046	<sup>2</sup> AAIJ	18S LHCB	Repl. by AAIJ 19L
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0.201 ± 0.057 ± 0.040	<sup>3</sup> AAIJ	15AF LHCB	Repl. by AAIJ 18S
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0.31 ± 0.12 ± 0.04	AAIJ	12F LHCB	Repl. by AAIJ 15AF
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<sup>1</sup> Untagged and time-integrated analysis within 150 MeV of the  $K^{*0}$  mass.

<sup>2</sup> Measured in angular analysis, which takes into account  $S$ -,  $P$ - and  $D$ -wave. contributions.

<sup>3</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>
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<b>0.38 ± 0.11 ± 0.04</b>	AAIJ	12F LHCB	$p\bar{p}$ at 7 TeV
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### $\Gamma_{\parallel}/\Gamma$ 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>
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<b>0.297 ± 0.029 ± 0.042</b>	<sup>1</sup> AAIJ	18S LHCB	$p\bar{p}$ at 7, 8 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.215 ± 0.046 ± 0.015	AAIJ	15AF LHCB	Repl. by AAIJ 18S
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<sup>1</sup> Measured in angular analysis, which takes into account  $S$ -,  $P$ - and  $D$ -wave. contributions.

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b>2.40±0.11±0.33</b>	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5.31±0.24±0.14	AAIJ	15AF	LHCB Repl. by AAIJ 18S

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

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

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
<b>2.62±0.26±0.64</b>	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV

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

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

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

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

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

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

VALUE (rad)	DOCUMENT ID	TECN	COMMENT
<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.

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.73±0.15±0.04</b>	AAIJ	18AY	LHCB $pp$ at 7 and 8 TeV

$\Gamma_L/\Gamma$  in  $B_s^0 \rightarrow K^*(892)^0 \bar{K}_2^*(1430)^0$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.911±0.020±0.165</b>	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV

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

$\Gamma_{\parallel}/\Gamma$  in  $B_s^0 \rightarrow K^*(892)^0 \bar{K}_2^*(1430)^0$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.012±0.008±0.053</b>	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV

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

$\Gamma_L/\Gamma$  in  $B_s^0 \rightarrow K_2^*(1430)^0 \bar{K}^*(892)^0$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.62±0.16±0.25</b>	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV

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

$\Gamma_{\parallel}/\Gamma$  in  $B_s^0 \rightarrow K_2^*(1430)^0 \bar{K}^*(892)^0$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.24 \pm 0.10 \pm 0.14$	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV

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

$\Gamma_L/\Gamma$  in  $B_s^0 \rightarrow K_2^*(1430)^0 \bar{K}_2^*(1430)^0$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.25 \pm 0.14 \pm 0.18$	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV

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

$\Gamma_{\parallel 1}/\Gamma$  in  $B_s^0 \rightarrow K_2^*(1430)^0 \bar{K}_2^*(1430)^0$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.17 \pm 0.11 \pm 0.14$	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV

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

$\Gamma_{\perp 1}/\Gamma$  in  $B_s^0 \rightarrow K_2^*(1430)^0 \bar{K}_2^*(1430)^0$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.30 \pm 0.18 \pm 0.21$	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV

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

$\Gamma_{\parallel 2}/\Gamma$  in  $B_s^0 \rightarrow K_2^*(1430)^0 \bar{K}_2^*(1430)^0$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.015 \pm 0.033 \pm 0.107$	<sup>1</sup> AAIJ	18S	LHCB $pp$ at 7, 8 TeV

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
$0.20^{+0.08}_{-0.09} \pm 0.02$	AAIJ	15AQ	LHCB $pp$ 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
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$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $2.00 < q^2 < 5.0 \text{ GeV}^2/c^4$ )

VALUE	DOCUMENT ID	TECN	COMMENT
$0.68^{+0.16}_{-0.13} \pm 0.03$	AAIJ	15AQ	LHCB $pp$ 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
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<sup>1</sup> Measured in  $2.0 < q^2 < 4.3 \text{ GeV}^2/c^4$ .

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

VALUE	DOCUMENT ID	TECN	COMMENT
$0.54^{+0.10}_{-0.09} \pm 0.02$	AAIJ	15AQ	LHCB $pp$ 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
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<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>
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<b><math>0.29 \pm 0.11 \pm 0.04</math></b>	AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
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• • • 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
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<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>
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<b><math>0.23^{+0.09}_{-0.08} \pm 0.02</math></b>	AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
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• • • 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
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<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>
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<b><math>0.40^{+0.13}_{-0.15} \pm 0.02</math></b>	AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
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• • • 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
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<sup>1</sup> Measured in  $16.0 < q^2 < 19.0 \text{ GeV}^2/c^4$ .

**$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $15.0 < q^2 < 18.9 \text{ GeV}^2/c^4$ )**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b><math>0.359 \pm 0.031 \pm 0.019</math></b>	AAIJ	21AK LHCB	$pp$ at 7, 8, 13 TeV
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**$F_L(B_s^0 \rightarrow \phi \mu^+ \mu^-)$  ( $1.00 < q^2 < 6.00 \text{ GeV}^2/c^4$ )**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b><math>0.715 \pm 0.036 \pm 0.013</math></b>	AAIJ	21AK LHCB	$pp$ at 7, 8, 13 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.63^{+0.09}_{-0.09} \pm 0.03$	AAIJ	15AQ LHCB	Repl. by AAIJ 21AK
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$0.56^{+0.17}_{-0.16} \pm 0.09$	AAIJ	13X LHCB	Repl. by AAIJ 15AQ
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## $B_s^0\text{-}\bar{B}_s^0$ MIXING

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

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

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

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

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

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

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

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

“OUR EVALUATION” is provided by the Heavy Flavor Averaging Group (HFLAV, <https://hflav.web.cern.ch/>) by taking into account correlations between measurements.

VALUE ( $10^{12} \hbar s^{-1}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>17.765 ±0.006</b>		<b>OUR EVALUATION</b>		
<b>17.765 ±0.005</b>		<b>OUR AVERAGE</b>		
17.7683 ±0.0051 ±0.0032		1 AAIJ	22B LHCb	$pp$ at 13 TeV
17.757 ±0.007 ±0.008		2 AAIJ	21M LHCb	$pp$ at 7, 8, 13 TeV
17.51 $^{+0.10}_{-0.09}$ ±0.03		3 SIRUNYAN	21E CMS	$pp$ at 13 TeV
17.703 ±0.059 ±0.018		4 AAIJ	19Q LHCb	$pp$ at 13 TeV
17.768 ±0.023 ±0.006		1 AAIJ	13BI LHCb	$pp$ at 7 TeV
17.93 ±0.22 ±0.15		5 AAIJ	13CF LHCb	$pp$ at 7 TeV
17.77 ±0.10 ±0.07		6 ABULENCIA,A	06G CDF	$p\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
17.711 $^{+0.055}_{-0.057}$ ±0.011		4 AAIJ	15I LHCb	Repl. by AAIJ 19Q
17.63 ±0.11 ±0.02		7 AAIJ	12I LHCb	Repl. by AAIJ 21M
17–21	90	8 ABAZOV	06B D0	$p\bar{p}$ at 1.96 TeV
17.31 $^{+0.33}_{-0.18}$ ±0.07		9 ABULENCIA	06Q CDF	Repl. by ABULEN- CIA,A 06G
> 8.0	95	10 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 4.9	95	11 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 8.5	95	12 ABDALLAH	04J DLPH	$e^+e^- \rightarrow Z^0$
> 5.0	95	13 ABDALLAH	03B DLPH	$e^+e^- \rightarrow Z$
>10.3	95	14 ABE	03 SLD	$e^+e^- \rightarrow Z$
>10.9	95	15 HEISTER	03E ALEP	$e^+e^- \rightarrow Z$

> 5.3	95	16	ABE	02V	SLD	$e^+e^- \rightarrow Z$
> 1.0	95	17	ABBIENDI	01D	OPAL	$e^+e^- \rightarrow Z$
> 7.4	95	18	ABREU	00Y	DLPH	Repl. by ABDALLAH 04J
> 4.0	95	19	ABREU,P	00G	DLPH	$e^+e^- \rightarrow Z$
> 5.2	95	20	ABBIENDI	99S	OPAL	$e^+e^- \rightarrow Z$
<96	95	21	ABE	99D	CDF	$p\bar{p}$ at 1.8 TeV
> 5.8	95	22	ABE	99J	CDF	$p\bar{p}$ at 1.8 TeV
> 9.6	95	23	BARATE	99J	ALEP	$e^+e^- \rightarrow Z$
> 7.9	95	24	BARATE	98C	ALEP	Repl. by BARATE 99J
> 3.1	95	25	ACKERSTAFF	97U	OPAL	Repl. by ABBIENDI 99S
> 2.2	95	26	ACKERSTAFF	97V	OPAL	Repl. by ABBIENDI 99S
> 6.5	95	27	ADAM	97	DLPH	Repl. by ABREU 00Y
> 6.6	95	28	BUSKULIC	96M	ALEP	Repl. by BARATE 98C
> 2.2	95	26	AKERS	95J	OPAL	Sup. by ACKERSTAFF 97V
> 5.7	95	29	BUSKULIC	95J	ALEP	$e^+e^- \rightarrow Z$
> 1.8	95	26	BUSKULIC	94B	ALEP	$e^+e^- \rightarrow Z$

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

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

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

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

<sup>5</sup> Measured using  $B_s^0 \rightarrow D_s^- \mu^+ \nu_\mu X$  decays.

<sup>6</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>7</sup> Measured using  $B_s^0 \rightarrow D_s^- \pi^+$  and  $D_s^- \pi^+ \pi^- \pi^+$  decays.

<sup>8</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>9</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>10</sup> Uses leptons emitted with large momentum transverse to a jet and improved techniques for vertexing and flavor-tagging.

<sup>11</sup> Updates of  $D_s$ -lepton analysis.

<sup>12</sup> Combined results from all Delphi analyses.

<sup>13</sup> Events with a high transverse momentum lepton were removed and an inclusively reconstructed vertex was required.

<sup>14</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>15</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>16</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>17</sup> Uses fully or partially reconstructed  $D_s \ell$  vertices and a mixing tag as a flavor tagging.

<sup>18</sup> Replaced by ABDALLAH 04A. Uses  $D_s^- \ell^+$ , and  $\phi \ell^+$  vertices, and a multi-variable discriminant as a flavor tagging.

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

VALUE DOCUMENT ID  
**27.03±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  
**0.499319±0.000005 OUR EVALUATION**

### CP VIOLATION PARAMETERS in $B_s^0$

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

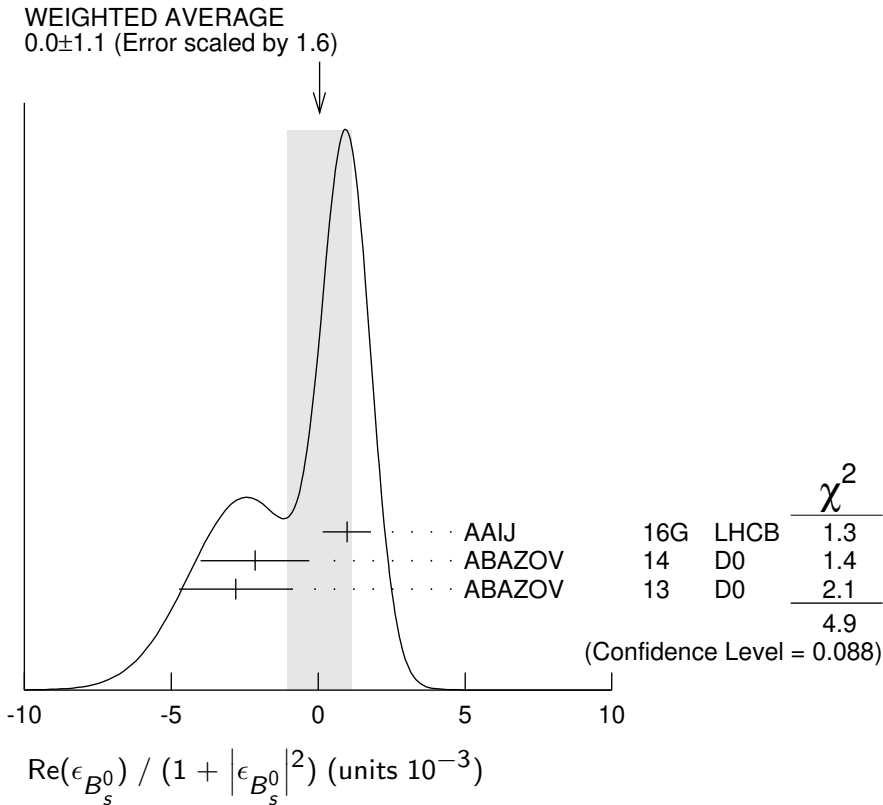
CP impurity in  $B_s^0$  system.

"OUR EVALUATION" is an average obtained by the Heavy Flavor Averaging Group (HFLAV, <https://hflav.web.cern.ch/>) and described at <https://hflav.web.cern.ch/>. 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  $4 \times \text{Re}(\epsilon_{B_0}) / (1 + |\epsilon_{B_0}|^2)$ .

<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  $B_0^0$ , 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>0.162 \pm 0.035</math> OUR AVERAGE</b>			
$0.164 \pm 0.034 \pm 0.014$	AAIJ	210	LHCB $pp$ at 13 TeV
$0.14 \pm 0.11 \pm 0.03$	AAIJ	13B0	LHCB $pp$ at 7 TeV

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.14 \pm 0.05</math> OUR AVERAGE</b>	Error includes scale factor of 1.3.		
$0.123 \pm 0.034 \pm 0.015$	AAIJ	210	LHCB $pp$ at 13 TeV
$0.30 \pm 0.12 \pm 0.04$	AAIJ	13B0	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>0.37_{-0.09}^{+0.10}</math></b>	<sup>1</sup> AAIJ	18U	LHCB $pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.53_{-0.16}^{+0.17}$	<sup>2</sup> AAIJ	14BF	LHCB Repl. by AAIJ 18U

<sup>1</sup> Measured in  $B_s^0 \rightarrow D_s^\mp K^\pm$  decays, constraining  $-2\beta_s$  by the measurement of  $\phi_s = -0.030 \pm 0.033$  from HFLAV.

<sup>2</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.

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.47 \pm 0.08_{-0.03}^{+0.02}</math></b>	<sup>1,2</sup> AAIJ	21M	LHCB $pp$ at 7, 8, 13 TeV

<sup>1</sup> Measured in restricted phase space with  $m(K^+ \pi^+ \pi^-) < 1950$  MeV,  $m(K^+ \pi^-) < 1200$  MeV and  $m(\pi^+ \pi^-) < 1200$  MeV.

<sup>2</sup> A model-independent coherence factor for the decay  $B_s \rightarrow D_s K \pi \pi$  (in the restricted phase space region) is also reported.

### $\delta_B(B_S^0 \rightarrow D_S^\pm K^\mp)$

VALUE ( $^\circ$ )	DOCUMENT ID	TECN	COMMENT
$358^{+13}_{-14}$	<sup>1</sup> AAIJ	18U LHCb	$pp$ at 7, 8 TeV

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

$3^{+19}_{-20}$	<sup>2</sup> AAIJ	14BF LHCb	Repl. by AAIJ 18U
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<sup>1</sup> Measured in  $B_S^0 \rightarrow D_S^\mp K^\pm$  decays, constraining  $-2\beta_S$  by the measurement of  $\phi_S = 0.030 \pm 0.033$  from HFLAV. The value is modulo  $180^\circ$ .

<sup>2</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.

### $\delta_B(B_S^0 \rightarrow D_S^\pm K^\mp \pi^\pm \pi^\mp)$

VALUE ( $^\circ$ )	DOCUMENT ID	TECN	COMMENT
$-6^{+10+2}_{-12-4}$	<sup>1,2</sup> AAIJ	21M LHCb	$pp$ at 7, 8, 13 TeV

<sup>1</sup> Measured in restricted phase space with  $m(K^+ \pi^+ \pi^-) < 1950$  MeV,  $m(K^+ \pi^-) < 1200$  MeV and  $m(\pi^+ \pi^-) < 1200$  MeV. The value is modulo  $180^\circ$ .

<sup>2</sup> A model-independent coherence factor for the decay  $B_S \rightarrow D_S K \pi \pi$  (in the restricted phase space region) is also reported.

### 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, <https://hflav.web.cern.ch/>) and are described at <https://hflav.web.cern.ch/>. The averaging/scaling procedure takes into account correlation between the measurements.

VALUE ( $10^{-2}$ rad)	DOCUMENT ID	TECN	COMMENT
<b><math>2.5 \pm 1.0</math> OUR EVALUATION</b>			
<b><math>2.3 \pm 1.0</math> OUR AVERAGE</b>			
$4.35 \pm 1.80 \pm 1.05$	<sup>1</sup> AAD	21AE ATLS	$pp$ at 7, 8, 13 TeV
$0 \pm 14 \pm 4$	<sup>2</sup> AAIJ	21AN LHCb	$pp$ at 7, 8 TeV
$1.05 \pm 2.20 \pm 0.50$	<sup>3</sup> SIRUNYAN	21E CMS	$pp$ at 8, 13 TeV
$-0.1 \pm 2.2 \pm 0.6$	<sup>4</sup> AAIJ	19AF LHCb	$pp$ at 7, 8, 13 TeV
$4.15 \pm 2.05 \pm 0.30$	<sup>5</sup> AAIJ	19Q LHCb	$pp$ at 13 TeV
$-5.95 \pm 5.35 \pm 1.70$	<sup>6</sup> AAIJ	17V LHCb	$pp$ at 7, 8 TeV
$-11.5^{+14}_{-14.5} \pm 1$	<sup>7</sup> AAIJ	16AK LHCb	$pp$ at 7, 8 TeV
$2.9 \pm 2.5 \pm 0.3$	<sup>8</sup> AAIJ	15I LHCb	$pp$ at 7, 8 TeV
$-1 \pm 9 \pm 1$	<sup>9</sup> AAIJ	14AY LHCb	$pp$ at 7, 8 TeV
	<sup>10</sup> AALTONEN	12AJ CDF	$p\bar{p}$ at 1.96 TeV
$28^{+18}_{-19}$	<sup>11</sup> ABAZOV	12D D0	$p\bar{p}$ at 1.96 TeV

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

$3.7 \pm 5.8 \pm 1.4$	$12,^{13}$	AAIJ	19AP	LHCB	$\rho\rho$ at 7, 8, 13 TeV
$5.0 \pm 6.5 \pm 7.0$	$^{14}$	AAIJ	18S	LHCB	$\rho\rho$ at 7, 8 TeV
$4.5 \pm 3.9 \pm 2.1$	$^{15}$	AAD	16AP	ATLS	Repl. by AAD 21AE
$3.75 \pm 4.85 \pm 1.55$	$^{16}$	KHACHATRY...	16S	CMS	Repl. by SIRUNYAN 21E
$6 \begin{matrix} + 8 \\ - 7 \end{matrix}$	$^{17,^{18}}$	AAIJ	15K	LHCB	$\rho\rho$ at 7, 8 TeV
$-6 \pm 13 \pm 3$	$^{19}$	AAD	14U	ATLS	Repl. by AAD 21AE
$8.5 \pm 7.5 \pm 1.5$	$^{20}$	AAIJ	14AE	LHCB	Repl. by AAIJ 19AP
$-3.5 \pm 3.4 \pm 0.4$	$^{21}$	AAIJ	14S	LHCB	Repl. by AAIJ 19AF
$-0.5 \pm 3.5 \pm 0.5$	$^{22}$	AAIJ	13AR	LHCB	Repl. by AAIJ 15I
	$^{23}$	AAIJ	13AY	LHCB	$\rho\rho$ at 7 TeV
$-11.0 \pm 20.5 \pm 5.0$	$^{24}$	AAD	12CV	ATLS	Repl. by AAD 14U
$22 \pm 22 \pm 1$	$^{25}$	AAIJ	12B	LHCB	Repl. by AAIJ 12Q
$-8 \pm 9 \pm 3$	$^{26}$	AAIJ	12D	LHCB	Repl. by AAIJ 13AR
$0.95 \begin{matrix} + 8.70 + 0.15 \\ - 8.65 - 0.20 \end{matrix}$	$^{27}$	AAIJ	12Q	LHCB	Repl. by AAIJ 13AR
	$^{28}$	AALTONEN	12D	CDF	Repl. by AALTONEN 12AJ
	$^{29}$	AALTONEN	08G	CDF	Repl. by AALTONEN 12D
$28 \begin{matrix} + 12 & + 4 \\ - 15 & - 1 \end{matrix}$	$^{11,^{30}}$	ABAZOV	08AMD0		Repl. by ABAZOV 12D
$39.5 \pm 28.0 \begin{matrix} + 0.5 \\ - 7.0 \end{matrix}$	$^{31,^{32}}$	ABAZOV	07	D0	Repl. by ABAZOV 07N
$35 \begin{matrix} + 20 \\ - 24 \end{matrix}$	$^{32,^{33}}$	ABAZOV	07N	D0	Repl. by ABAZOV 08AM

<sup>1</sup> AAD 21AE measured  $\phi_s = -2\beta_s = -0.087 \pm 0.036 \pm 0.021$  rad. using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>2</sup> AAIJ 21AN measured  $\phi_s = -2\beta_s = 0.00 \pm 0.28 \pm 0.07$  rad, using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays with  $J/\psi \rightarrow e^+e^-$ .

<sup>3</sup> SIRUNYAN 21E measured  $\phi_s = -2\beta_s = -0.021 \pm 0.044 \pm 0.010$  rad. using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi\phi$  decays.

<sup>4</sup> AAIJ 19AF reports  $\phi_s = -2\beta_s = 0.002 \pm 0.044 \pm 0.012$  rad. and  $|\lambda| = 0.949 \pm 0.036 \pm 0.019$ , when direct  $CP$  violation is allowed. Measured using a time-dependent fit to  $B_s^0 \rightarrow J/\psi\pi^+\pi^-$  decays, which is sensitive to  $\phi_s(s\bar{s}s)$ , not  $\phi_s(c\bar{c}s)$ .

<sup>5</sup> AAIJ 19Q reports  $\phi_s = -2\beta_s = -0.083 \pm 0.041 \pm 0.006$  rad. that was measured using a time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi K^+ K^-$  decays.

<sup>6</sup> Measured  $\phi_s = -2\beta_s = 0.119 \pm 0.107 \pm 0.034$  rad using time-dependent angular analysis of  $B_s^0 \rightarrow J/\psi K^+ K^-$  in the region  $m(KK) > 1.05$  GeV.

<sup>7</sup> AAIJ 16AK reports  $\phi_s = -2\beta_s = 0.23 \begin{matrix} + 0.29 \\ - 0.28 \end{matrix} \pm 0.02$  rad. that was measured using a time-dependent angular analysis of  $B_s^0 \rightarrow \psi(2S)\phi$  decays.

<sup>8</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>9</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>10</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.

- 11 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.
- 12 AAIJ 19AP reports  $\phi_s^{s\bar{s}s} = -0.073 \pm 0.115 \pm 0.027$  rad and  $|\lambda| = 0.99 \pm 0.05 \pm 0.01$ . Measured using a time-dependent fit to  $B_s^0 \rightarrow \phi\phi$  decays, assuming independence of the helicity of the  $\phi\phi$  decay.
- 13 AAIJ 19AP reports also polarisation-dependent results assuming that the longitudinal weak phase is CP-conserving and that there is no direct CP violation, giving  $\phi_{s,\parallel} = 0.014 \pm 0.055 \pm 0.011$  rad and  $\phi_{s,\perp} = 0.044 \pm 0.059 \pm 0.019$  rad.
- 14 AAIJ 18S reports  $\phi_s = -2\beta_s = -0.10 \pm 0.13 \pm 0.14$  rad measured in  $B_s^0 \rightarrow (K^+\pi^-)(K^-\pi^+)$  in the region  $0.75 < m(K^\pm\pi^\mp) < 1.6$  GeV. This is a  $b \rightarrow d\bar{d}s$  transition with a decay amplitude phase different from that of  $b \rightarrow c\bar{c}s$  transition.
- 15 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.
- 16 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.
- 17 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  $B^0 \rightarrow \pi^+\pi^-$ .
- 18 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.
- 19 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.
- 20 AAIJ 14AE value 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. Also reports  $\phi_s = -0.17 \pm 0.15 \pm 0.03$  rad.
- 21 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.
- 22 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.
- 23 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.
- 24 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.
- 25 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.
- 26 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.
- 27 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>28</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>29</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>30</sup> Reports  $\phi_S = -2\beta_S$  and obtains 90% CL interval  $-0.03 < \beta_S < 0.60$  rad.

<sup>31</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>32</sup> Reports  $\phi_S$  which equals to  $-2\beta_S$ .

<sup>33</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>1.001±0.018 OUR AVERAGE</b>	Error includes scale factor of 1.2.		
0.972±0.026±0.008	<sup>1</sup> SIRUNYAN	21E CMS	$pp$ at 13 TeV
1.012±0.016±0.006	AAIJ	19Q LHCb	$pp$ at 13 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.964±0.019±0.007	AAIJ	15I LHCb	Repl. by AAIJ 19Q
<sup>1</sup> Measured using time-dependent angular analysis of $B_S^0 \rightarrow J/\psi\phi$ decays.			

### $|\lambda|$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.999±0.017 OUR AVERAGE</b>			
0.99 ±0.05 ±0.01	<sup>1</sup> AAIJ	19AP LHCb	$pp$ at 7, 8, 13 TeV
1.035±0.034±0.089	<sup>2</sup> AAIJ	18S LHCb	$pp$ at 7, 8 TeV
0.994±0.018±0.006	<sup>3</sup> AAIJ	17V LHCb	$pp$ at 7, 8 TeV
1.045 <sup>+0.069</sup> <sub>-0.050</sub> ±0.007	<sup>4</sup> AAIJ	16AK LHCb	$pp$ at 7, 8 TeV
0.91 <sup>+0.18</sup> <sub>-0.15</sub> ±0.02	<sup>5</sup> AAIJ	14AY LHCb	$pp$ at 7, 8 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.949±0.036±0.019	<sup>6</sup> AAIJ	19AF LHCb	$pp$ at 7, 8, 13 TeV
1.04 ±0.07 ±0.03	<sup>7</sup> AAIJ	14AE LHCb	Repl. by AAIJ 19AP

<sup>1</sup> Measured in  $B_S^0 \rightarrow \phi\phi$  decays.

<sup>2</sup> Measured in  $B_S^0 \rightarrow (K^+\pi^-)(K^-\pi^+)$  in the region  $0.75 < m(K^\pm\pi^\mp) < 1.6$  GeV.

<sup>3</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>4</sup> Measured using time-dependent angular analysis of  $B_S^0 \rightarrow \psi(2S)\phi$  decays.

<sup>5</sup> Measured in  $B_S^0 \rightarrow D_S^+ D_S^-$  decays.

<sup>6</sup> Measured using time-dependent analysis of  $B_S^0 \rightarrow J/\psi\pi^+\pi^-$  decays.

<sup>7</sup> Measured in  $B_S^0 \rightarrow \phi\phi$  decays.

### A, CP violation parameter

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>-0.79±0.08 OUR AVERAGE</b>			
-0.83±0.05±0.09	<sup>1</sup> AAIJ	210 LHCB	<i>pp</i> at 13 TeV
-0.79±0.07±0.10	<sup>1</sup> AAIJ	180 LHCB	<i>pp</i> at 7, 8 TeV
0.49 <sup>+0.77</sup> <sub>-0.65</sub> ±0.06	<sup>2</sup> AAIJ	15AL LHCB	<i>pp</i> at 7, 8 TeV

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

<sup>2</sup> Measured in  $B_S^0 \rightarrow J/\psi K_S^0$  decays.

### C, CP violation parameter

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.19±0.06 OUR AVERAGE</b>			
0.20±0.06±0.02	<sup>1</sup> AAIJ	180 LHCB	<i>pp</i> at 7, 8 TeV
-0.28±0.41±0.08	<sup>2</sup> AAIJ	15AL LHCB	<i>pp</i> at 7, 8 TeV
<sup>1</sup> Measured in $B_S^0 \rightarrow K^+ K^-$ decays.			
<sup>2</sup> Measured in $B_S^0 \rightarrow J/\psi K_S^0$ decays.			

### S, CP violation parameter

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.17±0.06 OUR AVERAGE</b>			
0.18±0.06±0.02	<sup>1</sup> AAIJ	180 LHCB	<i>pp</i> at 7, 8 TeV
-0.08±0.40±0.08	<sup>2</sup> AAIJ	15AL LHCB	<i>pp</i> at 7, 8 TeV
<sup>1</sup> Measured in $B_S^0 \rightarrow K^+ K^-$ decays.			
<sup>2</sup> Measured in $B_S^0 \rightarrow J/\psi K_S^0$ decays.			

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>-0.048±0.057±0.020</b>	AAIJ	15AV LHCB	<i>pp</i> at 7, 8 TeV

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.171±0.152±0.028</b>	AAIJ	15AV LHCB	<i>pp</i> at 7, 8 TeV

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>-0.049±0.096±0.025</b>	AAIJ	15AV LHCB	<i>pp</i> 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.

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.224 \pm 0.012</math></b> OUR AVERAGE			
$0.236 \pm 0.013 \pm 0.011$	AAIJ	210 LHCb	$pp$ at 13 TeV
$0.213 \pm 0.015 \pm 0.007$	AAIJ	180 LHCb	$pp$ at 7, 8 TeV
$0.22 \pm 0.07 \pm 0.02$	AALTONEN	14P CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.27 \pm 0.04 \pm 0.01$	AAIJ	13AX LHCb	Repl. by AAIJ 180
$0.27 \pm 0.08 \pm 0.02$	AAIJ	12V LHCb	Repl. by AAIJ 13AX
$0.39 \pm 0.15 \pm 0.08$	AALTONEN	11N CDF	Repl. by AALTONEN 14P

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>-0.04 \pm 0.07 \pm 0.02</math></b>	AAIJ	14BN LHCb	$pp$ at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.04 \pm 0.16 \pm 0.01$	AAIJ	13L LHCb	Repl. by AAIJ 14BN

### $A_{CP}(B_s^0 \rightarrow [\pi^+ K^-]_D K^*(892)^0)$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>-0.01 \pm 0.03 \pm 0.02</math></b>	AAIJ	14BN LHCb	$pp$ at 7, 8 TeV

### $A_{CP}(B_s^0 \rightarrow [\pi^+ \pi^-]_D K^*(892)^0)$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.06 \pm 0.13 \pm 0.02</math></b>	AAIJ	14BN LHCb	$pp$ at 7, 8 TeV

### $S(B_s^0 \rightarrow \phi\gamma)$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.43 \pm 0.30 \pm 0.11</math></b>	<sup>1</sup> AAIJ	19AE LHCb	$pp$ at 7, 8 TeV

<sup>1</sup> Measured in flavor tagged time dependent analysis.

### $C(B_s^0 \rightarrow \phi\gamma)$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.11 \pm 0.29 \pm 0.11</math></b>	<sup>1</sup> AAIJ	19AE LHCb	$pp$ at 7, 8 TeV

<sup>1</sup> Measured in flavor tagged time dependent analysis.

### $A^\Delta(B_s^0 \rightarrow \phi\gamma)$

$A^\Delta(B_s^0 \rightarrow \phi\gamma)$  is the multiplicative coefficient of the  $\sinh(\Delta\Gamma t/2)$  term in the  $B_s \rightarrow \phi\gamma$  decay rate time dependence.

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>-0.67^{+0.37}_{-0.41} \pm 0.17</math></b>	<sup>1</sup> AAIJ	19AE LHCb	$pp$ at 7, 8 TeV

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

$-0.98^{+0.46+0.23}_{-0.52-0.20}$	<sup>2</sup> AAIJ	17B LHCb	Repl. by AAIJ 19AE
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<sup>1</sup> Measured in flavor tagged time dependent analysis, using tagged and un-tagged events. This result updates AAIJ 17B with better selection efficiency and other analysis improvements.

<sup>2</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
<b><math>-0.47 \pm 0.39 \pm 0.08</math></b>		<sup>1</sup> AAIJ	16E LHCB	$pp$ at 7, 8 TeV
<b>&lt; 1.2</b>	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
<b><math>-0.89 \pm 1.41 \pm 0.36</math></b>	<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
<b><math>+1.01 \pm 2.08 \pm 0.71</math></b>	<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
<b><math>-3.83 \pm 2.09 \pm 0.71</math></b>	<sup>1</sup> AAIJ	16E LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays.

### $\text{Re}(\xi)$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>-0.022 \pm 0.033 \pm 0.003</math></b>	<sup>1</sup> AAIJ	16E LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Uses  $B_S^0 \rightarrow J/\psi K^+ K^-$  decays.

### $\text{Im}(\xi)$

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.004 \pm 0.011 \pm 0.002</math></b>	<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  $B_s \rightarrow \phi \ell^+ \ell^-$**  **$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $0.1 < q^2 < 2.0 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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**1.14 ± 0.16 OUR AVERAGE**

1.11 $^{+0.14}_{-0.13}$ ± 0.09	<sup>1</sup> AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
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2.78 ± 0.95 ± 0.89	AALTONEN	11AI CDF	$p\bar{p}$ at 1.96 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.897 $^{+0.207}_{-0.186}$ ± 0.097	<sup>1</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
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<sup>1</sup> Measured in  $B_s^0 \rightarrow \phi \mu^+ \mu^-$  decays. **$B(B_s^0 \rightarrow \phi \ell^+ \ell^-)$  ( $0.1 < q^2 < 0.98 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-8}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>6.81 ± 0.47 ± 0.34</b>	<sup>1</sup> AAIJ	21AG LHCB	$pp$ at 7, 8, 13 TeV
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<sup>1</sup> Measured in  $B_s^0 \rightarrow \phi \mu^+ \mu^-$  decays **$B(B_s^0 \rightarrow \phi \ell^+ \ell^-)$  ( $1.1 < q^2 < 2.5 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-8}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>4.41 ± 0.41 ± 0.24</b>	<sup>1</sup> AAIJ	21AG LHCB	$pp$ at 7, 8, 13 TeV
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<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>
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<b>0.77 ± 0.12 ± 0.06</b>	<sup>1</sup> AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.529 $^{+0.182}_{-0.159}$ ± 0.057	<sup>1,2</sup> AAIJ	13X LHCB	Repl. by AAIJ 15AQ
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0.58 ± 0.55 ± 0.19	<sup>2</sup> AALTONEN	11AI CDF	$p\bar{p}$ at 1.96 TeV
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<sup>1</sup> Measured in  $B_s^0 \rightarrow \phi \mu^+ \mu^-$  decays.<sup>2</sup> Measured in  $2 < q^2 < 4.3 \text{ GeV}^2/c^4$ . **$B(B_s^0 \rightarrow \phi \ell^+ \ell^-)$  ( $2.5 < q^2 < 4.0 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-8}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>3.51 ± 0.39 ± 0.18</b>	<sup>1</sup> AAIJ	21AG LHCB	$pp$ at 7, 8, 13 TeV
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<sup>1</sup> Measured in  $B_s^0 \rightarrow \phi \mu^+ \mu^-$  decays **$B(B_s^0 \rightarrow \phi \ell^+ \ell^-)$  ( $4.0 < q^2 < 6.0 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-8}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>6.22 ± 0.48 ± 0.32</b>	<sup>1</sup> AAIJ	21AG LHCB	$pp$ at 7, 8, 13 TeV
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<sup>1</sup> Measured in  $B_s^0 \rightarrow \phi \mu^+ \mu^-$  decays **$B(B_s \rightarrow \phi \ell^+ \ell^-)$  ( $5.0 < q^2 < 8.0 \text{ GeV}^2/c^4$ )**

<u>VALUE (units <math>10^{-7}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>0.96 ± 0.13 ± 0.08</b>	<sup>1</sup> AAIJ	15AQ LHCB	$pp$ at 7, 8 TeV
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• • • 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  $4.3 < q^2 < 8.68 \text{ GeV}^2/c^4$ .

### $B(B_s^0 \rightarrow \phi\ell^+\ell^-) (6.0 < q^2 < 8.0 \text{ GeV}^2/c^4)$

VALUE (units $10^{-8}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>6.30 \pm 0.48 \pm 0.32</math></b>	<sup>1</sup> AAIJ	21AG LHCb	$pp$ at 7, 8, 13 TeV

<sup>1</sup> Measured in  $B_s^0 \rightarrow \phi\mu^+\mu^-$  decays

### $B(B_s \rightarrow \phi\ell^+\ell^-) (11.0 < q^2 < 12.5 \text{ GeV}^2/c^4)$

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>0.717 \pm 0.045 \pm 0.036</math></b>	<sup>1</sup> AAIJ	21AG LHCb	$pp$ at 7, 8, 13 TeV

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

$0.71 \pm 0.10 \pm 0.06$       <sup>1</sup> AAIJ      15AQ LHCb    Repl. by AAIJ 21AG

$1.18^{+0.22}_{-0.21} \pm 0.14$       <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  $10.9 < q^2 < 12.86 \text{ GeV}^2/c^4$ .

### $B(B_s^0 \rightarrow \phi\ell^+\ell^-) (15.0 < q^2 < 19.0 \text{ GeV}^2/c^4)$

VALUE (units $10^{-8}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>18.52 \pm 0.80 \pm 1.00</math></b>	<sup>1</sup> AAIJ	21AG LHCb	$pp$ at 7, 8, 13 TeV

<sup>1</sup> Measured in  $B_s^0 \rightarrow \phi\mu^+\mu^-$  decays

### $B(B_s \rightarrow \phi\ell^+\ell^-) (15.0 < q^2 < 17.0 \text{ GeV}^2/c^4)$

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>1.050 \pm 0.058 \pm 0.054</math></b>	<sup>1</sup> AAIJ	21AG LHCb	$pp$ at 7, 8, 13 TeV

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

$0.90 \pm 0.11 \pm 0.07$       <sup>1</sup> AAIJ      15AQ LHCb    Repl. by AAIJ 21AG

$0.760^{+0.189}_{-0.169} \pm 0.087$       <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  $14.18 < q^2 < 16 \text{ GeV}^2/c^4$ .

### $B(B_s \rightarrow \phi\ell^+\ell^-) (17.0 < q^2 < 19.0 \text{ GeV}^2/c^4)$

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b><math>0.838 \pm 0.058 \pm 0.046</math></b>	<sup>1</sup> AAIJ	21AG LHCb	$pp$ at 7, 8, 13 TeV

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

$0.79 \pm 0.11 \pm 0.07$       <sup>1</sup> AAIJ      15AQ LHCb    Repl. by AAIJ 21AG

$1.06^{+0.23}_{-0.21} \pm 0.12$       <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>1.44 ± 0.11 OUR AVERAGE</b>			
1.440 ± 0.075 ± 0.075	<sup>1</sup> AAIJ	21AG LHCb	$pp$ at 7, 8, 13 TeV
1.14 ± 0.79 ± 0.36	AALTONEN	11A1 CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.29 ± 0.16 ± 0.10	<sup>1</sup> AAIJ	15AQ LHCb	Repl. by AAIJ 21AG
1.14 $^{+0.25}_{-0.23}$ ± 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	11A1 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  $2.5 < \eta < 4.5$ .

## $B_s^0 \rightarrow D_s^{*-} \ell^+ \nu_\ell$ FORM FACTORS

### $\rho^2$ (form factor slope)

VALUE	DOCUMENT ID	TECN	COMMENT
<b>1.17 ± 0.08 OUR AVERAGE</b>			
1.16 ± 0.05 ± 0.07	<sup>1</sup> AAIJ	20AW LHCb	$pp$ at 13 TeV
1.23 ± 0.17 ± 0.05	<sup>2</sup> AAIJ	20E LHCb	$pp$ at 7,8 TeV

<sup>1</sup> The  $B_s^0 \rightarrow D_s^{*-} \mu^+ \nu_\mu$  decay is reconstructed through the decays of  $D_s^{*-} \rightarrow D_s^- \gamma$ ,  $D_s^- \rightarrow K^- K^+ \pi^-$ .

<sup>2</sup> The  $B_s^0 \rightarrow D_s^{*-} \mu^+ \nu_\mu$  decay is reconstructed inclusively without  $\gamma$  from the decays of  $D_s^{*-} \rightarrow D_s^- \gamma$ ,  $D_s^- \rightarrow K^- K^+ \pi^-$ .

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AAIJ	22B	NATP 18 1	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	22N	PR D105 072005	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	22Q	JHEP 2203 109	R. Aaij <i>et al.</i>	(LHCb Collab.)
BHUYAN	22	PR D105 012007	B. Bhuyan <i>et al.</i>	(BELLE Collab.)
PANG	22	PR D106 L051103	T. Pang <i>et al.</i>	(BELLE Collab.)
TUMASYAN	22AI	EPJ C82 499	A. Tumasyan <i>et al.</i>	(CMS Collab.)
WANG	22	PR D105 012004	B. Wang <i>et al.</i>	(BELLE Collab.)
AAD	21AE	EPJ C81 342	G. Aad <i>et al.</i>	(ATLAS Collab.)
AAIJ	21AG	PRL 127 151801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	21AK	JHEP 2111 043	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	21AN	EPJ C81 1026	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	21C	JHEP 2102 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
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AAIJ	21M	JHEP 2103 137	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	21N	JHEP 2103 099	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	21O	JHEP 2103 075	R. Aaij <i>et al.</i>	(LHCb Collab.)
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AAIJ	20F	PR D102 012011	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	20W	PRL 124 211802	R. Aaij <i>et al.</i>	(LHCb Collab.)
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)
SIRUNYAN	20AG	JHEP 2004 188	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
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AAIJ	19AK	PRL 123 211801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	19AP	JHEP 1912 155	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	19K	JHEP 1906 114	R. Aaij <i>et al.</i>	(LHCb Collab.)
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AAIJ	19Q	EPJ C79 706	R. Aaij <i>et al.</i>	(LHCb Collab.)
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AAIJ	19U	PRL 122 191804	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	18AB	JHEP 1807 020	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	18AC	JHEP 1808 191	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	18AY	PR D98 071103	R. Aaij <i>et al.</i>	(LHCb Collab.)
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AAIJ	18O	PR D98 032004	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	18S	JHEP 1803 140	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	18T	JHEP 1803 078	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	18U	JHEP 1803 059	R. Aaij <i>et al.</i>	(LHCb Collab.)
SIRUNYAN	18BY	EPJ C78 457	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAIJ	17A	PR D95 012006	R. Aaij <i>et al.</i>	(LHCb Collab.)
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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.)
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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.)
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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.)
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AAIJ	15AG	JHEP 1508 005	R. Aaij <i>et al.</i>	(LHCb Collab.)
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AAIJ	15AQ	JHEP 1509 179	R. Aaij <i>et al.</i>	(LHCb Collab.)
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AAIJ	15S	PL B743 46	R. Aaij <i>et al.</i>	(LHCb Collab.)
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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.)
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AAIJ	13AA	NP B871 403	R. Aaij <i>et al.</i>	(LHCb Collab.)
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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.)

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AAIJ	13Z	JHEP 1309 006	R. Aaij <i>et al.</i>	(LHCb Collab.)
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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.)

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