

$\Upsilon(10860)$

$$J^{PC} = 0^{-}(1^{-})^{-}$$

 $\Upsilon(10860)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10885.2^{+2.6}_{-1.6} OUR AVERAGE			
10885.3 \pm 1.5 ^{+2.2} _{-0.9}	¹ MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
10884.7 ^{+3.6} _{-3.4} ^{+8.9} _{-1.0}	² MIZUK	16	BELL $e^+e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
10882 \pm 1	³ DONG	20A	$e^+e^- \rightarrow b\bar{b}$
10881.8 ^{+1.0} _{-1.1} \pm 1.2	^{4,5} SANTEL	16	BELL $e^+e^- \rightarrow$ hadrons
10891.1 \pm 3.2 ^{+1.2} _{-2.0}	^{6,7} SANTEL	16	BELL $e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
10879 \pm 3	^{8,9} CHEN	10	BELL $e^+e^- \rightarrow$ hadrons
10888.4 ^{+2.7} _{-2.6} \pm 1.2	¹⁰ CHEN	10	BELL $e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
10876 \pm 2	⁸ AUBERT	09E	BABR $e^+e^- \rightarrow$ hadrons
10869 \pm 2	¹¹ AUBERT	09E	BABR $e^+e^- \rightarrow$ hadrons
10868 \pm 6 \pm 5	¹² BESSON	85	CLEO $e^+e^- \rightarrow$ hadrons
10845 \pm 20	¹³ LOVELOCK	85	CUSB $e^+e^- \rightarrow$ hadrons

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.

⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

⁷ Superseded by MIZUK 19.

⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

- ⁹ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.
¹⁰ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.
¹¹ In a model where a non-resonant $b\bar{b}$ -continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.
¹² Assuming four Gaussians with radiative tails and a single step in R .
¹³ In a coupled-channel model with three resonances and a smooth step in R .

$\Upsilon(10860)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
37 ± 4 OUR AVERAGE			
$36.6^{+4.5+0.5}_{-3.9-1.1}$	¹ MIZUK	19 BELL	$e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
$40.6^{+12.7+1.1}_{-8.0-19.1}$	² MIZUK	16 BELL	$e^+e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
49.5 ± 1.5	³ DONG	20A	$e^+e^- \rightarrow b\bar{b}$
$48.5^{+1.9+2.0}_{-1.8-2.8}$	^{4,5} SANTEL	16 BELL	$e^+e^- \rightarrow \text{hadrons}$
$53.7^{+7.1+1.3}_{-5.6-5.4}$	^{6,7} SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
46^{+9}_{-7}	^{8,9} CHEN	10 BELL	$e^+e^- \rightarrow \text{hadrons}$
$30.7^{+8.3}_{-7.0} \pm 3.1$	¹⁰ CHEN	10 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
43 ± 4	⁸ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$
74 ± 4	¹¹ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$
$112 \pm 17 \pm 23$	¹² BESSON	85 CLEO	$e^+e^- \rightarrow \text{hadrons}$
110 ± 15	¹³ LOVELOCK	85 CUSB	$e^+e^- \rightarrow \text{hadrons}$

- ¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.
² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.
³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.
⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).
⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.
⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase,

and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

⁷ Superseded by MIZUK 19.

⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

⁹ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

¹⁰ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

¹¹ In a model where a non-resonant $b\bar{b}$ -continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.

¹² Assuming four Gaussians with radiative tails and a single step in R .

¹³ In a coupled-channel model with three resonances and a smooth step in R .

$\Upsilon(10860)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $B\bar{B}X$	(76.2 $^{+2.7}_{-4.0}$) %	
Γ_2 $B\bar{B}$	(5.5 ± 1.0) %	
Γ_3 $B\bar{B}^* + \text{c.c.}$	(13.7 ± 1.6) %	
Γ_4 $B^*\bar{B}^*$	(38.1 ± 3.4) %	
Γ_5 $B\bar{B}^{(*)}\pi$	< 19.7 %	90%
Γ_6 $B\bar{B}\pi$	(0.0 ± 1.2) %	
Γ_7 $B^*\bar{B}\pi + B\bar{B}^*\pi$	(7.3 ± 2.3) %	
Γ_8 $B^*\bar{B}^*\pi$	(1.0 ± 1.4) %	
Γ_9 $B\bar{B}\pi\pi$	< 8.9 %	90%
Γ_{10} $B_s^{(*)}\bar{B}_s^{(*)}$	(20.1 ± 3.1) %	
Γ_{11} $B_s\bar{B}_s$	(5 ± 5) $\times 10^{-3}$	
Γ_{12} $B_s\bar{B}_s^* + \text{c.c.}$	(1.35 ± 0.32) %	
Γ_{13} $B_s^*\bar{B}_s^*$	(17.6 ± 2.7) %	
Γ_{14} no open-bottom	(3.8 $^{+5.0}_{-0.5}$) %	
Γ_{15} e^+e^-	(8.3 ± 2.1) $\times 10^{-6}$	
Γ_{16} $K^*(892)^0\bar{K}^0$	< 1.0 $\times 10^{-5}$	90%
Γ_{17} $\Upsilon(1S)\pi^+\pi^-$	(5.3 ± 0.6) $\times 10^{-3}$	
Γ_{18} $\Upsilon(2S)\pi^+\pi^-$	(7.8 ± 1.3) $\times 10^{-3}$	
Γ_{19} $\Upsilon(3S)\pi^+\pi^-$	(4.8 $^{+1.9}_{-1.7}$) $\times 10^{-3}$	
Γ_{20} $\Upsilon(1S)K^+K^-$	(6.1 ± 1.8) $\times 10^{-4}$	
Γ_{21} $\eta\Upsilon_J(1D)$	(4.8 ± 1.1) $\times 10^{-3}$	
Γ_{22} $h_b(1P)\pi^+\pi^-$	(3.5 $^{+1.0}_{-1.3}$) $\times 10^{-3}$	
Γ_{23} $h_b(2P)\pi^+\pi^-$	(5.7 $^{+1.7}_{-2.1}$) $\times 10^{-3}$	
Γ_{24} $\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	(2.5 ± 2.3) $\times 10^{-3}$	

Γ_{25}	$\chi_{b0}(1P)\pi^+\pi^-\pi^0$	< 6.3	$\times 10^{-3}$	90%
Γ_{26}	$\chi_{b0}(1P)\omega$	< 3.9	$\times 10^{-3}$	90%
Γ_{27}	$\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	< 4.8	$\times 10^{-3}$	90%
Γ_{28}	$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	$(1.85 \pm 0.33) \times 10^{-3}$		
Γ_{29}	$\chi_{b1}(1P)\omega$	$(1.57 \pm 0.30) \times 10^{-3}$		
Γ_{30}	$\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	$(5.2 \pm 1.9) \times 10^{-4}$		
Γ_{31}	$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	$(1.17 \pm 0.30) \times 10^{-3}$		
Γ_{32}	$\chi_{b2}(1P)\omega$	$(6.0 \pm 2.7) \times 10^{-4}$		
Γ_{33}	$\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	$(6 \pm 4) \times 10^{-4}$		
Γ_{34}	$\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega$	< 3.8	$\times 10^{-5}$	90%
Γ_{35}	$\eta_b(1S)\omega$	< 1.3	$\times 10^{-3}$	90%
Γ_{36}	$\eta_b(2S)\omega$	< 5.6	$\times 10^{-3}$	90%

Inclusive Decays.

These decay modes are submodes of one or more of the decay modes above.

Γ_{37}	ϕ anything	$(13.8^{+2.4}_{-1.7})\%$
Γ_{38}	D^0 anything + c.c.	$(108 \pm 8)\%$
Γ_{39}	D_s anything + c.c.	$(46 \pm 6)\%$
Γ_{40}	J/ψ anything	$(2.06 \pm 0.21)\%$
Γ_{41}	B^0 anything + c.c.	$(77 \pm 8)\%$
Γ_{42}	B^+ anything + c.c.	$(72 \pm 6)\%$

$\Upsilon(10860)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$					Γ_{15}
<u>VALUE (keV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
0.31 \pm 0.07 OUR AVERAGE	Error includes scale factor of 1.3.				
0.22 \pm 0.05 \pm 0.07	BESSION	85	CLEO	$e^+e^- \rightarrow$ hadrons	
0.365 \pm 0.070	LOVELOCK	85	CUSB	$e^+e^- \rightarrow$ hadrons	

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$					$\Gamma_{15}\Gamma_{17}/\Gamma$
<u>VALUE (eV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		

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

1.09 \pm 0.34	^{1,2} MIZUK	19	BELL	$e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
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¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² Reported as the range 0.75–1.43 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$					$\Gamma_{15}\Gamma_{18}/\Gamma$
<u>VALUE (eV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		

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

2.58 \pm 1.22	^{1,2} MIZUK	19	BELL	$e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
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¹ From a simultaneous fit to the $\mathcal{T}(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\mathcal{T}(10860)$.

² Reported as the range 1.35–3.80 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

$\Gamma(e^+e^-) \times \Gamma(\mathcal{T}(3S)\pi^+\pi^-)/\Gamma_{\text{total}}$ $\Gamma_{15}\Gamma_{19}/\Gamma$

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

0.73 ± 0.30	^{1,2} MIZUK	19	BELL $e^+e^- \rightarrow \mathcal{T}(nS)\pi^+\pi^-$
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¹ From a simultaneous fit to the $\mathcal{T}(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\mathcal{T}(10860)$.

² Reported as the range 0.43–1.03 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

$\mathcal{T}(10860)$ BRANCHING RATIOS

“OUR EVALUATION” is obtained based on averages of rescaled data listed below. The averages and rescaling were performed by the Heavy Flavor Averaging Group (HFLAV) and are described at <https://hflav.web.cern.ch/>.

$\Gamma(B\bar{B}X)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.762^{+0.027}_{-0.043} OUR EVALUATION

0.71 ± 0.06 OUR AVERAGE

0.737 ± 0.032 ± 0.051	1063	¹ DRUTSKOY	10	BELL $\mathcal{T}(5S) \rightarrow B^+X, B^0X$
0.589 ± 0.100 ± 0.092		² HUANG	07	CLEO $\mathcal{T}(5S) \rightarrow \text{hadrons}$

¹ Not independent of DRUTSKOY 10 values for $\mathcal{T}(5S) \rightarrow B^{\pm,0}$ anything.

² Using measurements or limits from AQUINES 06.

$\Gamma(B\bar{B})/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10 ⁻²)	CL%	DOCUMENT ID	TECN	COMMENT
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5.5^{+1.0}_{-0.9} ± 0.4		¹ DRUTSKOY	10	BELL $\mathcal{T}(5S) \rightarrow B^+X, B^0X$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<13.8	90	² HUANG	07	CLEO $\mathcal{T}(5S) \rightarrow \text{hadrons}$
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¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

$\Gamma(B\bar{B})/\Gamma(B\bar{B}X)$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<0.22	90	AQUINES	06	CLE3 $\mathcal{T}(5S) \rightarrow \text{hadrons}$
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$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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0.137 ± 0.016 OUR AVERAGE

0.137 ± 0.013 ± 0.011	¹ DRUTSKOY	10	BELL $\mathcal{T}(5S) \rightarrow B^+X, B^0X$
0.143 ± 0.053 ± 0.027	² HUANG	07	CLEO $\mathcal{T}(5S) \rightarrow \text{hadrons}$

¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma(B\bar{B}X)$					Γ_3/Γ_1
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.24±0.09±0.03	10	AQUINES	06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

$\Gamma(B^*\bar{B}^*)/\Gamma_{\text{total}}$					Γ_4/Γ
<u>VALUE</u>		<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.381±0.034 OUR AVERAGE					
0.375 ^{+0.021} _{-0.019} ±0.030		¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
0.436±0.083±0.072		² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

$\Gamma(B^*\bar{B}^*)/\Gamma(B\bar{B}X)$					Γ_4/Γ_1
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.74±0.15±0.08	31	AQUINES	06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

$\Gamma(B\bar{B}^*)\pi/\Gamma_{\text{total}}$					Γ_5/Γ
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<0.197	90	¹ HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

¹ Using measurements or limits from AQUINES 06.

$\Gamma(B\bar{B}^*)\pi/\Gamma(B\bar{B}X)$					Γ_5/Γ_1
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<0.32	90	AQUINES	06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

$\Gamma(B\bar{B}\pi)/\Gamma_{\text{total}}$					Γ_6/Γ
<u>VALUE (units 10⁻²)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.0±1.2±0.3	0	¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^{+,0}\pi^-X$

¹ Assuming isospin conservation.

$[\Gamma(B^*\bar{B}\pi) + \Gamma(B\bar{B}^*\pi)]/\Gamma_{\text{total}}$					Γ_7/Γ
<u>VALUE (units 10⁻²)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
7.3^{+2.3}_{-2.1}±0.8	38	¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^{+,0}\pi^-X$

¹ Assuming isospin conservation.

$\Gamma(B^*\bar{B}^*\pi)/\Gamma_{\text{total}}$					Γ_8/Γ
<u>VALUE (units 10⁻²)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1.0^{+1.4}_{-1.3}±0.4	5	¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^{+,0}\pi^-X$

¹ Assuming isospin conservation.

$\Gamma(B\bar{B}\pi\pi)/\Gamma_{\text{total}}$					Γ_9/Γ
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<0.089	90	¹ HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

¹ Using measurements or limits from AQUINES 06.

$\Gamma(B\bar{B}\pi\pi)/\Gamma(B\bar{B}X)$	Γ_9/Γ_1			
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<0.14	90	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma_{\text{total}}$	$\Gamma_{10}/\Gamma = (\Gamma_{11}+\Gamma_{12}+\Gamma_{13})/\Gamma$		
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>

0.201^{+0.030}_{-0.031} OUR EVALUATION

0.189^{+0.027}_{-0.021} OUR AVERAGE

0.172 ± 0.030	¹ ESEN	13	BELL	$\Upsilon(5S) \rightarrow D^0 X, D_s X$
0.21 ^{+0.06} _{-0.03}	² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow D_s X$

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

0.180 ± 0.013 ± 0.032	³ DRUTSKOY	07	BELL	$\Upsilon(5S) \rightarrow D^0 X, D_s X$
0.160 ± 0.026 ± 0.058	⁴ ARTUSO	05B	CLEO	$e^+ e^- \rightarrow D_X X$

¹ Supersedes DRUTSKOY 07.

² Supersedes ARTUSO 05B. Combining inclusive ϕ , D_s , and B measurements. Using $B(D_s^+ \rightarrow \phi\pi^+) = 4.4 \pm 0.6\%$ from PDG 06.

³ Using $B(D_s^+ \rightarrow \phi\pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

⁴ Uses a model-dependent estimate $B(B_s \rightarrow D_s X) = (92 \pm 11)\%$.

$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma(B\bar{B}X)$	Γ_{10}/Γ_1
<u>VALUE</u>	<u>DOCUMENT ID</u>

0.264^{+0.052}_{-0.045} OUR EVALUATION

$\Gamma(B_s^* \bar{B}_s^*)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$	$\Gamma_{13}/\Gamma_{10} = \Gamma_{13}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$			
<u>VALUE (units 10⁻²)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>

87.8 ± 1.5 OUR AVERAGE

87.0 ± 1.7	1,2	ESEN	13	BELL	$B_s^0 \rightarrow D_s^- \pi^+$	
90.5 ± 3.2 ± 0.1	227	2,3	LI	12	BELL	$B_s^0 \rightarrow J/\psi \eta^{(\prime)}$

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

90.1 ^{+3.8} _{-4.0} ± 0.2	⁴ LOUVOT	09	BELL	10.86 $e^+ e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$
93 ⁺⁷ ₋₉ ± 1	⁴ DRUTSKOY	07A	BELL	Superseded by LOUVOT 09

¹ Supersedes LOUVOT 09.

² With $N(B_s^{(*)}\bar{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.

³ The ratios $N(B_s^* \bar{B}_s^*) / N(B_s^{(*)}\bar{B}_s^{(*)})$ and $N(B_s^* \bar{B}_s^0) / N(B_s^{(*)}\bar{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72 .

⁴ From a measurement of $\sigma(e^+ e^- \rightarrow B_s^* \bar{B}_s^*) / \sigma(e^+ e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)})$ at $\sqrt{s} = 10.86$ GeV.

$\Gamma(B_s \bar{B}_s)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$	$\Gamma_{11}/\Gamma_{10} = \Gamma_{11}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$		
<u>VALUE (units 10⁻²)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>

2.6^{+2.6}_{-2.5} LOUVOT 09 BELL 10.86 $e^+ e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$

$\Gamma(B_s \bar{B}_s) / \Gamma(B_s^* \bar{B}_s^*)$					$\Gamma_{11} / \Gamma_{13}$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.16	90	BONVICINI	06	CLE3	$e^+ e^-$

$\Gamma(B_s \bar{B}_s^* + \text{c.c.}) / \Gamma(B_s^{(*)} \bar{B}_s^{(*)})$					$\Gamma_{12} / \Gamma_{10} = \Gamma_{12} / (\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	

6.7 ± 1.2 OUR AVERAGE

7.3 ± 1.4		1,2 ESEN	13	BELL	$B_s^0 \rightarrow D_s^- \pi^+$
4.9 ± 2.5 ± 0.0	227	2,3 LI	12	BELL	$B_s^0 \rightarrow J/\psi \eta^{(\prime)}$

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

7.3 ^{+3.3} _{-3.0} ± 0.1		LOUVOT	09	BELL	10.86 $e^+ e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)}$
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¹ Supersedes LOUVOT 09.

² With $N(B_s^{(*)} \bar{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.

³ The ratios $N(B_s^* \bar{B}_s^*) / N(B_s^{(*)} \bar{B}_s^{(*)})$ and $N(B_s^* \bar{B}_s^0) / N(B_s^{(*)} \bar{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72 .

$\Gamma(B_s \bar{B}_s^* + \text{c.c.}) / \Gamma(B_s^* \bar{B}_s^*)$					$\Gamma_{12} / \Gamma_{13}$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.16	90	BONVICINI	06	CLE3	$e^+ e^-$

$\Gamma(\text{no open-bottom}) / \Gamma_{\text{total}}$	DOCUMENT ID				Γ_{14} / Γ
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0.038^{+0.051}_{-0.005} OUR EVALUATION

$\Gamma(K^*(892)^0 \bar{K}^0) / \Gamma_{\text{total}}$					Γ_{16} / Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<1.0 × 10 ⁻⁵	90	SHEN	13A	BELL	$e^+ e^- \rightarrow K^*(892)^0 \bar{K}^0$

$\Gamma(\eta \Upsilon_J(1D)) / \Gamma_{\text{total}}$					Γ_{21} / Γ
VALUE (units 10^{-3})		DOCUMENT ID	TECN	COMMENT	
4.82 ± 0.92 ± 0.67		¹ TAMPONI	18	BELL	$e^+ e^- \rightarrow \Upsilon(5S) \rightarrow \eta X$

¹ Mainly $J = 2$, assumes no continuum contribution under $\Upsilon(5S)$.

$\Gamma(\Upsilon(1S) \pi^+ \pi^-) / \Gamma_{\text{total}}$					Γ_{17} / Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
5.3 ± 0.3 ± 0.5	325	¹ CHEN	08	BELL	10.87 $e^+ e^- \rightarrow \Upsilon(1S) \pi^+ \pi^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

$\Gamma(\Upsilon(2S) \pi^+ \pi^-) / \Gamma_{\text{total}}$					Γ_{18} / Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
7.8 ± 0.6 ± 1.1	186	¹ CHEN	08	BELL	10.87 $e^+ e^- \rightarrow \Upsilon(2S) \pi^+ \pi^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

$\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
$4.8^{+1.8}_{-1.5} \pm 0.7$	10	¹ CHEN	08	BELL	$10.87 e^+ e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

$\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{\text{total}}$					Γ_{20}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
$6.1^{+1.6}_{-1.4} \pm 1.0$	20	¹ CHEN	08	BELL	$10.87 e^+ e^- \rightarrow \Upsilon(1S)K^+K^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$					Γ_{22}/Γ_{18}
VALUE		DOCUMENT ID	TECN	COMMENT	
$0.45 \pm 0.08^{+0.07}_{-0.12}$		ADACHI	12	BELL	$10.86 e^+ e^- \rightarrow \text{hadrons}$

$\Gamma(h_b(2P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$					Γ_{23}/Γ_{18}
VALUE		DOCUMENT ID	TECN	COMMENT	
$0.77 \pm 0.08^{+0.22}_{-0.17}$		ADACHI	12	BELL	$10.86 e^+ e^- \rightarrow \text{hadrons}$

$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(h_b(2P)\pi^+\pi^-)$					Γ_{22}/Γ_{23}
VALUE		DOCUMENT ID	TECN	COMMENT	
$0.616 \pm 0.052 \pm 0.017$		MIZUK	16	BELL	$e^+ e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$

$\Gamma(\chi_{bJ}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_{24}/Γ
VALUE (units 10^{-3})		DOCUMENT ID	TECN	COMMENT	
$2.5 \pm 0.6 \pm 2.2$		YIN	18	BELL	$e^+ e^- \rightarrow \text{hadrons}$

$\Gamma(\chi_{b0}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_{25}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 6.3 \times 10^{-3}$	90	¹ HE	14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

$\Gamma(\chi_{b0}(1P)\omega)/\Gamma_{\text{total}}$					Γ_{26}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 3.9 \times 10^{-3}$	90	¹ HE	14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

$\Gamma(\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$					Γ_{27}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 4.8 \times 10^{-3}$	90	¹ HE	14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

$\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.85±0.23±0.23	80	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

$\Gamma(\chi_{b1}(1P)\omega)/\Gamma_{\text{total}}$ Γ_{29}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.57±0.22±0.21	60	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

$\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$ Γ_{30}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.52±0.15±0.11	24	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

$\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.17±0.27±0.14	29	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

$\Gamma(\chi_{b2}(1P)\omega)/\Gamma_{\text{total}}$ Γ_{32}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.60±0.23±0.15	13	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

$\Gamma(\chi_{b2}(1P)\omega)/\Gamma(\chi_{b1}(1P)\omega)$ Γ_{32}/Γ_{29}

<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. • • •

0.38±0.16±0.09	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma \Upsilon(1S)$
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¹ Accounting for correlated systematics.

$\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$ Γ_{33}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.61±0.22±0.28	16	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

$\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})$ Γ_{33}/Γ_{30}

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

$1.20 \pm 0.55 \pm 0.65$		¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$
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¹ Accounting for correlated systematics.

$\Gamma(\eta_b(1S)\omega)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 1.3 \times 10^{-3}$	90	¹ OSKIN	20	BELL $e^+e^- \rightarrow \omega X$
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¹ Using $\sigma_{b\bar{b}} = 0.340 \pm 0.016$ nb from TAMPONI 15.

$\Gamma(\eta_b(2S)\omega)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 5.6 \times 10^{-3}$	90	¹ OSKIN	20	BELL $e^+e^- \rightarrow \omega X$
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¹ Using $\sigma_{b\bar{b}} = 0.340 \pm 0.016$ nb from TAMPONI 15.

$\Gamma(\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 3.8 \times 10^{-5}$	90	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$
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¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14. For a state X_b with mass between $10.55 \text{ GeV}/c^2$ and $10.65 \text{ GeV}/c^2$, the obtained 90% upper limit as a function of m_{X_b} varies from 2.6×10^{-5} to 3.8×10^{-5} .

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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$0.138 \pm 0.007^{+0.023}_{-0.015}$	HUANG	07	CLEO $\Upsilon(5S) \rightarrow \phi X$
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$\Gamma(D^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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$1.076 \pm 0.040 \pm 0.068$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D^0 X$
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$\Gamma(D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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0.46 ± 0.06 OUR AVERAGE

$0.472 \pm 0.024 \pm 0.072$	¹ DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D_s X$
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$0.44 \pm 0.09 \pm 0.04$	² ARTUSO	05B	CLE3 $e^+e^- \rightarrow D_s X$
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¹ Using $B(D_s^+ \rightarrow \phi\pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

² ARTUSO 05B reports $[\Gamma(\Upsilon(10860) \rightarrow D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)] = 0.0198 \pm 0.0019 \pm 0.0038$ which we divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.5 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(J/\psi \text{ anything})/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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$2.060 \pm 0.160 \pm 0.134$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow J/\psi X$
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$\Gamma(B^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{41}/Γ
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
$0.770^{+0.058}_{-0.056} \pm 0.061$	352	DRUTSKOY 10	BELL	$\gamma(5S) \rightarrow B^0 X$	

$\Gamma(B^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{42}/Γ
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
$0.721^{+0.039}_{-0.038} \pm 0.050$	711	DRUTSKOY 10	BELL	$\gamma(5S) \rightarrow B^+ X$	

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