$\Upsilon(10860)$

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

$\Upsilon(10860)$ 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	$e^+e^- \to \Upsilon(nS)\pi^+\pi^-$
$10884.7^{+3.6}_{-3.4}{}^{+8.9}_{-1.0}$	[2] MIZUK 16	BELL	$e^+e^- \to h_b(1P,2P)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10882 ± 1	[3] DONG 20A		$e^+e^- \to b\overline{b}$
$10881.8^{+1.0}_{-1.1} \pm 1.2$	[4,5] SANTEL 16	BELL	$e^+e^- \to$ hadrons
$10891.1 \pm 3.2^{+1.2}_{-2.0}$	[6,7] SANTEL 16	BELL	$e^+e^- \to \Upsilon(1S,2S,3S)\pi^+\pi^-$
10879 ± 3	[8,9] CHEN 10	BELL	$e^+e^- \to$ hadrons
$10888.4^{+2.7}_{-2.6} \pm 1.2$	[10] CHEN 10	BELL	$e^+e^- \to \Upsilon(1S,2S,3S)\pi^+\pi^-$
10876 ± 2	[8] AUBERT 09E	BABR	$e^+e^- \to$ hadrons
10869 ± 2	[11] AUBERT 09E	BABR	$e^+e^- \to$ hadrons
$10868 \pm 6 \pm 5$	[12] BESSON 85	CLEO	$e^+e^- \to$ hadrons
10845 ± 20	[13] LOVELOCK 85	CUSB	$e^+e^- \to$ hadrons

[1] From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1$, 2, 3, cross sections at 28 energy points within $\sqrt{s} = 10.6$–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 $\sqrt{s} = 10.77$–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 $\sqrt{s}$ = 10.82–11.05 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 25energy points within $\sqrt{s} = 10.6$–11.05 GeV to a pair of interfering Breit-Wigner amplitudesmodified by phase space factors, with fourteen resonance parameters (a mass, width, and threeamplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relativephase, and three decoherence coefficients, one for each n). Continuum contributions weremeasured (and therefore fixed) to be zero.

[7] Superseded by MIZUK 19.

[8] In a model where a flat non-resonant $b\overline{b}$-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 $b\overline{b}$-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.

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

[1] From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, n = 1, 2, 3, cross sections at 28 energy points within $\sqrt{s}$ = 10.6–11.05 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 $\sqrt{s}$ = 10.77–11.02 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 $\sqrt{s}$ = 10.82–11.05 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 25energy points within $\sqrt{s}$ = 10.6–11.05 GeV to a pair of interfering Breit-Wigner amplitudesmodified by phase space factors, with fourteen resonance parameters (a mass, width, and threeamplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relativephase,

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

7 Superseded by MIZUK 19.

8 In a model where a flat non-resonant $b\overline{b}$-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 $b\overline{b}$-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	$B\overline{B}X$	$(76.2\ ^{+2.7}_{-4.0})\ \%$	
Γ_2	$B\overline{B}$	$(5.5 \pm 1.0)\ \%$	
Γ_3	$B\overline{B}^* +$ c.c.	$(13.7 \pm 1.6)\ \%$	
Γ_4	$B^*\overline{B}^*$	$(38.1 \pm 3.4)\ \%$	
Γ_5	$B\overline{B}^{(*)}\pi$	$< 19.7\ \%$	90%
Γ_6	$B\overline{B}\pi$	$(0.0 \pm 1.2)\ \%$	
Γ_7	$B^*\overline{B}\pi + B\overline{B}^*\pi$	$(7.3 \pm 2.3)\ \%$	
Γ_8	$B^*\overline{B}^*\pi$	$(1.0 \pm 1.4)\ \%$	
Γ_9	$B\overline{B}\pi\pi$	$< 8.9\ \%$	90%
Γ_{10}	$B_s^{(*)}\overline{B}_s^{(*)}$	$(20.1 \pm 3.1)\ \%$	
Γ_{11}	$B_s\overline{B}_s$	$(5 \pm 5) \times 10^{-3}$	
Γ_{12}	$B_s\overline{B}_s^* +$ c.c.	$(1.35 \pm 0.32)\ \%$	
Γ_{13}	$B_s^*\overline{B}_s^*$	$(17.6 \pm 2.7)\ \%$	
Γ_{14}	no open-bottom	$(3.8\ ^{+5.0}_{-0.5})\ \%$	
Γ_{15}	e^+e^-	$(8.3 \pm 2.1) \times 10^{-6}$	
Γ_{16}	$K^*(892)^0\overline{K}^0$	$< 1.0 \times 10^{-5}$	90%
Γ_{17}	$\Upsilon(1S)\pi^+\pi^-$	$(5.3 \pm 0.6) \times 10^{-3}$	
Γ_{18}	$\Upsilon(1S)\eta$	$(8.5 \pm 1.7) \times 10^{-4}$	
Γ_{19}	$\Upsilon(1S)\eta'$	$< 6.9 \times 10^{-5}$	90%
Γ_{20}	$\Upsilon(2S)\pi^+\pi^-$	$(7.8 \pm 1.3) \times 10^{-3}$	
Γ_{21}	$\Upsilon(2S)\eta$	$(4.1 \pm 0.6) \times 10^{-3}$	
Γ_{22}	$\Upsilon(3S)\pi^+\pi^-$	$(4.8\ ^{+1.9}_{-1.7}) \times 10^{-3}$	
Γ_{23}	$\Upsilon(1S)K^+K^-$	$(6.1 \pm 1.8) \times 10^{-4}$	
Γ_{24}	$\eta\Upsilon_J(1D)$	$(4.8 \pm 1.1) \times 10^{-3}$	
Γ_{25}	$h_b(1P)\pi^+\pi^-$	$(3.5\ ^{+1.0}_{-1.3}) \times 10^{-3}$	

Γ_{26}	$h_b(2P)\pi^+\pi^-$	$(5.7\ ^{+1.7}_{-2.1}) \times 10^{-3}$	
Γ_{27}	$\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	$(2.5 \pm 2.3) \times 10^{-3}$	
Γ_{28}	$\chi_{b0}(1P)\pi^+\pi^-\pi^0$	$< 6.3 \times 10^{-3}$	90%
Γ_{29}	$\chi_{b0}(1P)\omega$	$< 3.9 \times 10^{-3}$	90%
Γ_{30}	$\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega}$	$< 4.8 \times 10^{-3}$	90%
Γ_{31}	$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	$(1.85 \pm 0.33) \times 10^{-3}$	
Γ_{32}	$\chi_{b1}(1P)\omega$	$(1.57 \pm 0.30) \times 10^{-3}$	
Γ_{33}	$\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega}$	$(5.2 \pm 1.9) \times 10^{-4}$	
Γ_{34}	$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	$(1.17 \pm 0.30) \times 10^{-3}$	
Γ_{35}	$\chi_{b2}(1P)\omega$	$(6.0 \pm 2.7) \times 10^{-4}$	
Γ_{36}	$\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega}$	$(6 \pm 4) \times 10^{-4}$	
Γ_{37}	$\gamma X_b \to \gamma \Upsilon(1S)\omega$	$< 3.8 \times 10^{-5}$	90%
Γ_{38}	$\eta_b(1S)\omega$	$< 1.3 \times 10^{-3}$	90%
Γ_{39}	$\eta_b(2S)\omega$	$< 5.6 \times 10^{-3}$	90%

Inclusive Decays.

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

Γ_{40}	ϕ anything	$(13.8\ ^{+2.4}_{-1.7})$ %
Γ_{41}	D^0 anything + c.c.	(108 ± 8) %
Γ_{42}	D_s anything + c.c.	(46 ± 6) %
Γ_{43}	J/ψ anything	(2.06 ± 0.21) %
Γ_{44}	B^0 anything + c.c.	(77 ± 8) %
Γ_{45}	B^+ anything + c.c.	(72 ± 6) %

Υ(10860) PARTIAL WIDTHS

$\Gamma(e^+e^-)$ Γ_{15}

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
0.31 ±0.07 OUR AVERAGE	Error includes scale factor of 1.3.			
$0.22 \pm 0.05 \pm 0.07$	BESSON	85	CLEO	$e^+e^- \to$ hadrons
0.365 ± 0.070	LOVELOCK	85	CUSB	$e^+e^- \to$ hadrons

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ $\Gamma_{15}\Gamma_{17}/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.09 ± 0.34	[1,2] MIZUK	19	BELL	$e^+e^- \to \Upsilon(\text{nS})\pi^+\pi^-$

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

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{total}$ — $\Gamma_{15}\Gamma_{20}/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.58 ± 1.22	[1,2] MIZUK	19	BELL	$e^+e^- \to \Upsilon(\mathrm{nS})\pi^+\pi^-$

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

[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.

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{total}$ — $\Gamma_{15}\Gamma_{22}/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.73 ± 0.30	[1,2] MIZUK	19	BELL	$e^+e^- \to \Upsilon(\mathrm{nS})\pi^+\pi^-$

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

[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.

$\Upsilon(10860)$ 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/.

$\Gamma(B\overline{B}X)/\Gamma_{total}$ — Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.762^{+0.027}_{-0.043}$ OUR EVALUATION					
0.71 ± 0.06 OUR AVERAGE					
$0.737\pm0.032\pm0.051$	1063	[1] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^+X,\ B^0X$
$0.589\pm0.100\pm0.092$		[2] HUANG	07	CLEO	$\Upsilon(5S) \to$ hadrons

[1] Not independent of DRUTSKOY 10 values for $\Upsilon(5S) \to B^{\pm,0}$ anything.

[2] Using measurements or limits from AQUINES 06.

$\Gamma(B\overline{B})/\Gamma_{total}$ — Γ_2/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID		TECN	COMMENT
$5.5^{+1.0}_{-0.9}\pm0.4$		[1] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^+X,\ B^0X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<13.8	90	[2] HUANG	07	CLEO	$\Upsilon(5S) \to$ hadrons

[1] Assuming isospin conservation.

[2] Using measurements or limits from AQUINES 06.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.22	90	AQUINES	06	CLE3	$\Upsilon(5S) \to$ hadrons

$\Gamma(B\overline{B}^* + \text{c.c.})/\Gamma_{total}$ — Γ_3/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.137±0.016 OUR AVERAGE				
0.137±0.013±0.011	[1] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^+ X,\ B^0 X$
0.143±0.053±0.027	[2] HUANG	07	CLEO	$\Upsilon(5S) \to$ hadrons

[1] Assuming isospin conservation.
[2] Using measurements or limits from AQUINES 06.

$\Gamma(B\overline{B}^* + \text{c.c.})/\Gamma(B\overline{B}X)$ — Γ_3/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.24±0.09±0.03	10	AQUINES	06	CLE3	$\Upsilon(5S) \to$ hadrons

$\Gamma(B^*\overline{B}^*)/\Gamma_{total}$ — Γ_4/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.381±0.034 OUR AVERAGE				
$0.375^{+0.021}_{-0.019}\pm0.030$	[1] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^+ X,\ B^0 X$
0.436±0.083±0.072	[2] HUANG	07	CLEO	$\Upsilon(5S) \to$ hadrons

[1] Assuming isospin conservation.
[2] Using measurements or limits from AQUINES 06.

$\Gamma(B^*\overline{B}^*)/\Gamma(B\overline{B}X)$ — Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.74±0.15±0.08	31	AQUINES	06	CLE3	$\Upsilon(5S) \to$ hadrons

$\Gamma(B\overline{B}^{(*)}\pi)/\Gamma_{total}$ — Γ_5/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.197	90	[1] HUANG	07	CLEO	$\Upsilon(5S) \to$ hadrons

[1] Using measurements or limits from AQUINES 06.

$\Gamma(B\overline{B}^{(*)}\pi)/\Gamma(B\overline{B}X)$ — Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.32	90	AQUINES	06	CLE3	$\Upsilon(5S) \to$ hadrons

$\Gamma(B\overline{B}\pi)/\Gamma_{total}$ — Γ_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.0±1.2±0.3	0	[1] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^{+,0}\pi^- X$

[1] Assuming isospin conservation.

$[\Gamma(B^*\overline{B}\pi) + \Gamma(B\overline{B}^*\pi)]/\Gamma_{total}$ — Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{7.3^{+2.3}_{-2.1}\pm0.8}$	38	[1] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^{+,0}\pi^- X$

[1] Assuming isospin conservation.

$\Gamma(B^*\overline{B}^*\pi)/\Gamma_{total}$ — Γ_8/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{1.0^{+1.4}_{-1.3}\pm0.4}$	5	[1] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^{+,0}\pi^- X$

[1] Assuming isospin conservation.

$\Gamma(B\overline{B}\pi\pi)/\Gamma_{total}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.089	90	[1] HUANG	07	CLEO	$\Upsilon(5S) \to$ hadrons

[1] Using measurements or limits from AQUINES 06.

$\Gamma(B\overline{B}\pi\pi)/\Gamma(B\overline{B}X)$ Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.14	90	AQUINES	06	CLE3	$\Upsilon(5S) \to$ hadrons

$\Gamma(B_s^{(*)}\overline{B}_s^{(*)})/\Gamma_{total}$ $\Gamma_{10}/\Gamma = (\Gamma_{11}+\Gamma_{12}+\Gamma_{13})/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$0.201^{+0.030}_{-0.031}$ OUR EVALUATION				
$0.189^{+0.027}_{-0.021}$ OUR AVERAGE				
0.172 ± 0.030	[1] ESEN	13	BELL	$\Upsilon(5S) \to D^0 X,\ D_s X$
$0.21\ ^{+0.06}_{-0.03}$	[2] HUANG	07	CLEO	$\Upsilon(5S) \to D_s X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.180 \pm 0.013 \pm 0.032$	[3] DRUTSKOY	07	BELL	$\Upsilon(5S) \to D^0 X,\ D_s X$
$0.160 \pm 0.026 \pm 0.058$	[4] ARTUSO	05B	CLEO	$e^+ e^- \to D_x X$

[1] Supersedes DRUTSKOY 07.
[2] Supersedes ARTUSO 05B. Combining inclusive ϕ, D_s, and B measurements. Using $B(D_s^+ \to \phi\pi^+) = 4.4 \pm 0.6\%$ from PDG 06.
[3] Using $B(D_s^+ \to \phi\pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.
[4] Uses a model-dependent estimate $B(B_s \to D_s X) = (92 \pm 11)\%$.

$\Gamma(B_s^{(*)}\overline{B}_s^{(*)})/\Gamma(B\overline{B}X)$ Γ_{10}/Γ_1

VALUE	DOCUMENT ID
$0.264^{+0.052}_{-0.045}$ OUR EVALUATION	

$\Gamma(B_s^*\overline{B}_s^*)/\Gamma(B_s^{(*)}\overline{B}_s^{(*)})$ $\Gamma_{13}/\Gamma_{10} = \Gamma_{13}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
87.8±1.5 OUR AVERAGE					
87.0 ± 1.7		[1,2] ESEN	13	BELL	$B_s^0 \to D_s^- \pi^+$
$90.5 \pm 3.2 \pm 0.1$	227	[2,3] LI	12	BELL	$B_s^0 \to J/\psi \eta^{(\prime)}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$90.1^{+3.8}_{-4.0} \pm 0.2$		[4] LOUVOT	09	BELL	$10.86\ e^+ e^- \to B_s^{(*)}\overline{B}_s^{(*)}$
$93\ ^{+7}_{-9}\ \pm 1$		[4] DRUTSKOY	07A	BELL	Superseded by LOUVOT 09

[1] Supersedes LOUVOT 09.
[2] With $N(B_s^{(*)}\overline{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.
[3] The ratios $N(B_s^*\overline{B}_s^*)$ / $N(B_s^{(*)}\overline{B}_s^{(*)})$ and $N(B_s^*\overline{B}_s^0)$ / $N(B_s^{(*)}\overline{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72.
[4] From a measurement of $\sigma(e^+ e^- \to B_s^*\overline{B}_s^*)$ / $\sigma(e^+ e^- \to B_s^{(*)}\overline{B}_s^{(*)})$ at $\sqrt{s} = 10.86$ GeV.

$\Gamma(B_s \overline{B}_s)/\Gamma(B_s^{(*)} \overline{B}_s^{(*)})$ $\Gamma_{11}/\Gamma_{10} = \Gamma_{11}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
$\mathbf{2.6^{+2.6}_{-2.5}}$	LOUVOT	09	BELL	10.86 $e^+ e^- \rightarrow B_s^{(*)} \overline{B}_s^{(*)}$

$\Gamma(B_s \overline{B}_s)/\Gamma(B_s^* \overline{B}_s^*)$ Γ_{11}/Γ_{13}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.16	90	BONVICINI	06	CLE3	$e^+ e^-$

$\Gamma(B_s \overline{B}_s^* + \text{c.c.})/\Gamma(B_s^{(*)} \overline{B}_s^{(*)})$ $\Gamma_{12}/\Gamma_{10} = \Gamma_{12}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$

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. • • •					
$7.3^{+3.3}_{-3.0}\pm0.1$		LOUVOT	09	BELL	10.86 $e^+ e^- \rightarrow B_s^{(*)} \overline{B}_s^{(*)}$

[1] Supersedes LOUVOT 09.

[2] With N($B_s^{(*)} \overline{B}_s^{(*)}$) = (7.11 ± 1.30) × 10^6.

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

$\Gamma(B_s \overline{B}_s^* + \text{c.c.})/\Gamma(B_s^* \overline{B}_s^*)$ Γ_{12}/Γ_{13}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.16	90	BONVICINI	06	CLE3	$e^+ e^-$

$\Gamma(\text{no open-bottom})/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	DOCUMENT ID
$\mathbf{0.038^{+0.051}_{-0.005}}$ **OUR EVALUATION**	

$\Gamma(K^*(892)^0 \overline{K}^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<1.0 \times 10^{-5}}$	90	SHEN	13A	BELL	$e^+ e^- \rightarrow K^*(892)^0 \overline{K}^0$

$\Gamma(\eta \Upsilon_J(1D))/\Gamma_{\text{total}}$ Γ_{24}/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.

$\Gamma(\Upsilon(1S)\eta)/\Gamma_{total}$ — Γ_{18}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.85±0.15±0.08	[1,2] KOVALENKO 21	BELL	$e^+e^- \to \Upsilon(5S)$

[1] Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.
[2] Using a data sample of 118.3 fb^{-1} of e^+e^- collisions at $\sqrt{s} = 10.866$ GeV.

$\Gamma(\Upsilon(1S)\eta')/\Gamma_{total}$ — Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<6.9 × 10⁻⁵	90	[1,2] KOVALENKO 21	BELL	$e^+e^- \to \Upsilon(5S)$

[1] Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.
[2] Using a data sample of 118.3 fb^{-1} of e^+e^- collisions at $\sqrt{s} = 10.866$ GeV.

$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{total}$ — Γ_{20}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.8±0.6±1.1	186	[1] CHEN 08	BELL	10.87 $e^+e^- \to \Upsilon(2S)\pi^+\pi^-$

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

$\Gamma(\Upsilon(2S)\eta)/\Gamma_{total}$ — Γ_{21}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
4.13±0.41±0.37	[1,2] KOVALENKO 21	BELL	$e^+e^- \to \Upsilon(5S)$

[1] Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.
[2] Using a data sample of 118.3 fb^{-1} of e^+e^- collisions at $\sqrt{s} = 10.866$ GeV.

$\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{total}$ — Γ_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$\mathbf{4.8^{+1.8}_{-1.5}\pm0.7}$	10	[1] CHEN 08	BELL	10.87 $e^+e^- \to \Upsilon(3S)\pi^+\pi^-$

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

$\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{total}$ — Γ_{23}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$\mathbf{6.1^{+1.6}_{-1.4}\pm1.0}$	20	[1] CHEN 08	BELL	10.87 $e^+e^- \to \Upsilon(1S)K^+K^-$

[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_{25}/Γ_{20}

VALUE	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.45\pm0.08^{+0.07}_{-0.12}}$	ADACHI 12	BELL	10.86 $e^+e^- \to$ hadrons

$\Gamma(h_b(2P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$ — Γ_{26}/Γ_{20}

VALUE	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.77\pm0.08^{+0.22}_{-0.17}}$	ADACHI 12	BELL	10.86 $e^+e^- \to$ hadrons

$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(h_b(2P)\pi^+\pi^-)$ — Γ_{25}/Γ_{26}

VALUE	DOCUMENT ID	TECN	COMMENT
0.616±0.052±0.017	MIZUK 16	BELL	$e^+e^- \to h_b(1P,2P)\pi^+\pi^-$

$\Gamma(\chi_{bJ}(1P)\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{27}/Γ

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
2.5±0.6±2.2	YIN	18	BELL	$e^+e^- \to$ hadrons

$\Gamma(\chi_{b0}(1P)\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.3 × 10^{-3}	90	[1] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

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

$\Gamma(\chi_{b0}(1P)\omega)/\Gamma_{total}$ — Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.9 × 10^{-3}	90	[1] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

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

$\Gamma(\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})/\Gamma_{total}$ — Γ_{30}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4.8 × 10^{-3}	90	[1] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

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

$\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{31}/Γ

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

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

$\Gamma(\chi_{b1}(1P)\omega)/\Gamma_{total}$ — Γ_{32}/Γ

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

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

$\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})/\Gamma_{total}$ — Γ_{33}/Γ

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

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

$\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{34}/Γ

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

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

$\Gamma(\chi_{b2}(1P)\omega)/\Gamma_{total}$ Γ_{35}/Γ

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

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

$\Gamma(\chi_{b2}(1P)\omega)/\Gamma(\chi_{b1}(1P)\omega)$ Γ_{35}/Γ_{32}

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.38±0.16±0.09	[1] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

[1] Accounting for correlated systematics.

$\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})/\Gamma_{total}$ Γ_{36}/Γ

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

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

$\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})/\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})$ Γ_{36}/Γ_{33}

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.20±0.55±0.65	[1] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

[1] Accounting for correlated systematics.

$\Gamma(\eta_b(1S)\omega)/\Gamma_{total}$ Γ_{38}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.3 × 10^{-3}	90	[1] OSKIN	20	BELL	$e^+e^- \to \omega X$

[1] Using $\sigma_{b\overline{b}} = 0.340 \pm 0.016$ nb from TAMPONI 15.

$\Gamma(\eta_b(2S)\omega)/\Gamma_{total}$ Γ_{39}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<5.6 × 10^{-3}	90	[1] OSKIN	20	BELL	$e^+e^- \to \omega X$

[1] Using $\sigma_{b\overline{b}} = 0.340 \pm 0.016$ nb from TAMPONI 15.

$\Gamma(\gamma X_b \to \gamma\Upsilon(1S)\omega)/\Gamma_{total}$ Γ_{37}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.8 × 10^{-5}	90	[1] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

[1] Assuming that all the $b\overline{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \to b\overline{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14. For a state X_b with mass between 10.55 GeV/c^2 and 10.65 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}.

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

VALUE	DOCUMENT ID		TECN	COMMENT
$0.138\pm0.007^{+0.023}_{-0.015}$	HUANG	07	CLEO	$\Upsilon(5S) \to \phi X$

$\Gamma(D^0$ anything + c.c.$)/\Gamma_{total}$ — Γ_{41}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
1.076±0.040±0.068	DRUTSKOY	07	BELL	$\Upsilon(5S) \to D^0 X$

$\Gamma(D_s$ anything + c.c.$)/\Gamma_{total}$ — Γ_{42}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.46 ±0.06 OUR AVERAGE				
0.472±0.024±0.072	[1] DRUTSKOY	07	BELL	$\Upsilon(5S) \to D_s X$
0.44 ±0.09 ±0.04	[2] ARTUSO	05B	CLE3	$e^+ e^- \to D_X X$

[1] Using B($D_s^+ \to \phi\pi^+$) = (4.4 ± 0.6)% from PDG 06.

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

$\Gamma(J/\psi$ anything$)/\Gamma_{total}$ — Γ_{43}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
2.060±0.160±0.134	DRUTSKOY	07	BELL	$\Upsilon(5S) \to J/\psi X$

$\Gamma(B^0$ anything + c.c.$)/\Gamma_{total}$ — Γ_{44}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.770^{+0.058}_{-0.056}\pm0.061}$	352	DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^0 X$

$\Gamma(B^+$ anything + c.c.$)/\Gamma_{total}$ — Γ_{45}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.721^{+0.039}_{-0.038}\pm0.050}$	711	DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^+ X$

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