

$D_{s1}(2460)^\pm$

$$I(J^P) = 0(1^+)^\pm$$

See the review on "Heavy Non- $q\bar{q}$ Mesons." **$D_{s1}(2460)^\pm$ MASS**

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2459.5±0.6 OUR FIT	Error includes scale factor of 1.1.			
2459.6±0.9 OUR AVERAGE	Error includes scale factor of 1.3.			
2460.1±0.2±0.8	1	AUBERT	06P BABR	10.6 e^+e^-
2458.0±1.0±1.0	195	AUBERT	04E BABR	10.6 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2459.5±1.2±3.7	920	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\gamma X$
2458.6±1.0±2.5	560	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0\gamma X$
2460.2±0.2±0.8	123	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^+\pi^- X$
2458.9±1.5	112	² AUBERT,B	04S BABR	$B \rightarrow D_{s1}(2460)^+\bar{D}^{(*)}$
2461.1±1.6	139	³ AUBERT,B	04S BABR	$B \rightarrow D_{s1}(2460)^+\bar{D}^{(*)}$
2456.5±1.3±1.3	126	^{4,5} MIKAMI	04 BELL	10.6 e^+e^-
2459.5±1.3±2.0	152	^{6,7} MIKAMI	04 BELL	10.6 e^+e^-
2459.9±0.9±1.6	60	^{6,7} MIKAMI	04 BELL	10.6 e^+e^-
2459.2±1.6±2.0	57	KROKOVNY	03B BELL	10.6 e^+e^-

¹ The average of the values obtained from the $D_s^+\gamma$, $D_s^+\pi^0\gamma$, $D_s^+\pi^+\pi^-$ final state.

² Systematic errors not evaluated. From the decay to $D_s^{*+}\pi^0$.

³ Systematic errors not evaluated. From the decay to $D_s^{*+}\gamma$.

⁴ Not independent of the corresponding $m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}}$.

⁵ Using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.

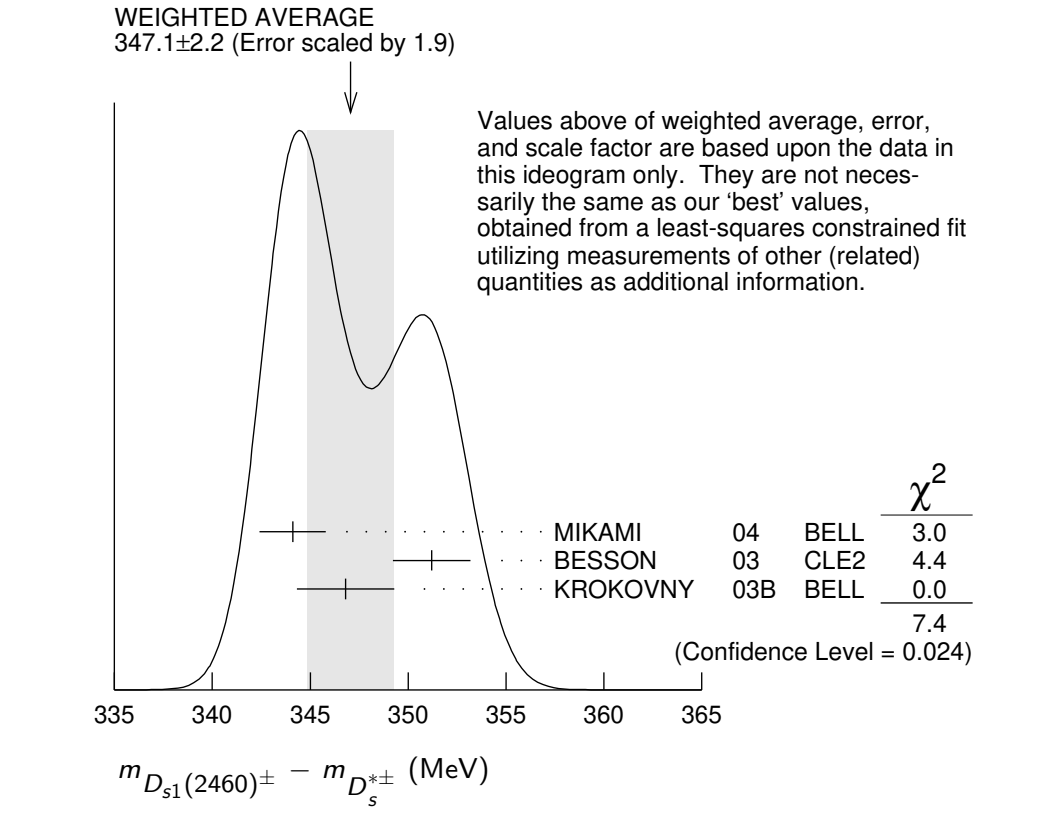
⁶ Not independent of the corresponding $m_{D_{s1}(2460)^\pm} - m_{D_s^\pm}$.

⁷ Using $m_{D_s^+} = 1968.5 \pm 0.6$ MeV.

 $m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}}$

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
347.3±0.7 OUR FIT	Error includes scale factor of 1.2.			
347.1±2.2 OUR AVERAGE	Error includes scale factor of 1.9. See the ideogram below.			
344.1±1.3±1.1	126	MIKAMI	04 BELL	10.6 e^+e^-
351.2±1.7±1.0	41	BESSON	03 CLE2	10.6 e^+e^-
346.8±1.6±1.9	57	⁸ KROKOVNY	03B BELL	10.6 e^+e^-
⁸ Recalculated by us using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.				



$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{\pm}}$

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D_s^{*\pm}$, D_s^{*0} , $D_1(2420)^0$, $D_2^{*}(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
491.1$\pm$0.6 OUR FIT	Error includes scale factor of 1.1.			
491.3$\pm$1.4 OUR AVERAGE				
491.0 $\pm$ 1.3 $\pm$ 1.9	152	⁹ MIKAMI	04 BELL	10.6 e^+e^-
491.4 $\pm$ 0.9 $\pm$ 1.5	60	¹⁰ MIKAMI	04 BELL	10.6 e^+e^-

⁹ From the decay to $D_s^{\pm}\gamma$.

¹⁰ From the decay to $D_s^{\pm}\pi^+\pi^-$.

$D_{s1}(2460)^{\pm}$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 3.5	95	123	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^+\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	95	560	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0\gamma X$
<10		195	AUBERT	04E BABR	10.6 e^+e^-
< 5.5	90	126	MIKAMI	04 BELL	10.6 e^+e^-
< 7	90	41	BESSON	03 CLE2	10.6 e^+e^-

$D_{s1}(2460)^+$ DECAY MODES

$D_{s1}(2460)^-$ modes are charge conjugates of the modes below.

Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$D_s^{*+}\pi^0$	(48 ±11) %	
Γ_2	$D_s^+\gamma$	(18 ± 4) %	
Γ_3	$D_s^+\pi^+\pi^-$	(4.3± 1.3) %	S=1.1
Γ_4	$D_s^{*+}\gamma$	< 8 %	CL=90%
Γ_5	$D_{s0}^*(2317)^+\gamma$	(3.7 ⁺ _{- 2.4}) %	
Γ_6	$D_s^+\pi^0$		
Γ_7	$D_s^+\pi^0\pi^0$		
Γ_8	$D_s^+\gamma\gamma$		

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 8 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 3.4$ for 4 degrees of freedom.

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

x_2	80		
x_3	68	62	
x_5	-3	25	26
	x_1	x_2	x_3

$D_{s1}(2460)^\pm$ BRANCHING RATIOS

$\Gamma(D_s^{*+}\pi^0)/\Gamma_{\text{total}}$	Γ_1/Γ				
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.48±0.11 OUR FIT					
0.56±0.13±0.09		¹¹ AUBERT	06N BABR	$B \rightarrow D_{s1}(2460)^-\overline{D}^{(*)}$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	41	BESSON	03 CLE2	10.6 e ⁺ e ⁻	
¹¹ Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.					

$\Gamma(D_s^+ \gamma)/\Gamma_{\text{total}}$	Γ_2/Γ				
VALUE	DOCUMENT ID	TECN	COMMENT		
0.18±0.04 OUR FIT					
0.16±0.04±0.03	¹² AUBERT	06N	BABR	$B \rightarrow D_{s1}(2460)^- \overline{D}^{(*)}$	
¹² Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.					

$\Gamma(D_s^+ \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_2 / Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.38 ± 0.05					OUR FIT
0.44 ± 0.09					OUR AVERAGE
0.55 ± 0.13 ± 0.08		152	MIKAMI	04	BELL 10.6 e ⁺ e ⁻
0.38 ± 0.11 ± 0.04		38	KROKOVNY	03B	BELL 10.6 e ⁺ e ⁻
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.274 ± 0.045 ± 0.020		251	¹³ AUBERT, B	04S	BABR $B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$
< 0.49		90	BESSION	03	CLE2 10.6 e ⁺ e ⁻
¹³ Used by AUBERT 06N in their measurement of $B(D_s^{*-} \pi^0)$ and $B(D_s^- \gamma)$.					

 $\Gamma(D_s^+ \pi^+ \pi^-) / \Gamma(D_s^{*+} \pi^0)$ Γ_3 / Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.090 ± 0.020					OUR FIT
Error includes scale factor of 1.2.					
0.14 ± 0.04 ± 0.02		60	MIKAMI	04	BELL 10.6 e ⁺ e ⁻
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.08		90	BESSION	03	CLE2 10.6 e ⁺ e ⁻

 $\Gamma(D_s^{*+} \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_4 / Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.16	90	BESSION	03	CLE2 10.6 e ⁺ e ⁻
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.31	90	MIKAMI	04	BELL 10.6 e ⁺ e ⁻

 $\Gamma(D_{s0}^{*}(2317)^+ \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_5 / Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.22	95	AUBERT	04E	BABR 10.6 e ⁺ e ⁻
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.58	90	BESSION	03	CLE2 10.6 e ⁺ e ⁻

 $\Gamma(D_s^{*+} \pi^0) / [\Gamma(D_s^{*+} \pi^0) + \Gamma(D_{s0}^{*}(2317)^+ \gamma)]$ $\Gamma_1 / (\Gamma_1 + \Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.93 ± 0.09			OUR FIT
0.97 ± 0.09 ± 0.05	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

 $\Gamma(D_s^+ \gamma) / [\Gamma(D_s^{*+} \pi^0) + \Gamma(D_{s0}^{*}(2317)^+ \gamma)]$ $\Gamma_2 / (\Gamma_1 + \Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.35 ± 0.04			OUR FIT
0.337 ± 0.036 ± 0.038	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

 $\Gamma(D_s^+ \pi^+ \pi^-) / [\Gamma(D_s^{*+} \pi^0) + \Gamma(D_{s0}^{*}(2317)^+ \gamma)]$ $\Gamma_3 / (\Gamma_1 + \Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.083 ± 0.017			OUR FIT
Error includes scale factor of 1.2.			
0.077 ± 0.013 ± 0.008	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

 $\Gamma(D_s^{*+} \gamma) / [\Gamma(D_s^{*+} \pi^0) + \Gamma(D_{s0}^{*}(2317)^+ \gamma)]$ $\Gamma_4 / (\Gamma_1 + \Gamma_5)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.24	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

$\Gamma(D_{s0}^*(2317)^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_5/(\Gamma_1+\Gamma_5)$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.25	95	AUBERT	06P	BABR	10.6 e^+e^-
$\Gamma(D_s^+\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_6/(\Gamma_1+\Gamma_5)$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.042	95	AUBERT	06P	BABR	10.6 e^+e^-
$\Gamma(D_s^+\pi^0\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_7/(\Gamma_1+\Gamma_5)$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.68	95	AUBERT	06P	BABR	10.6 e^+e^-
$\Gamma(D_s^+\gamma\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_8/(\Gamma_1+\Gamma_5)$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.33	95	AUBERT	06P	BABR	10.6 e^+e^-

$D_{s1}(2460)^\pm$ REFERENCES

AUBERT	06N	PR D74 031103	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	04E	PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)
BESSON	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)