

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

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

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	$B \rightarrow D_{s1}(2460)^+ \bar{D}^{*0}$
2461.1±1.6	139	³ AUBERT,B	04S BABR	$B \rightarrow D_{s1}(2460)^+ \bar{D}^{*0}$
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^-

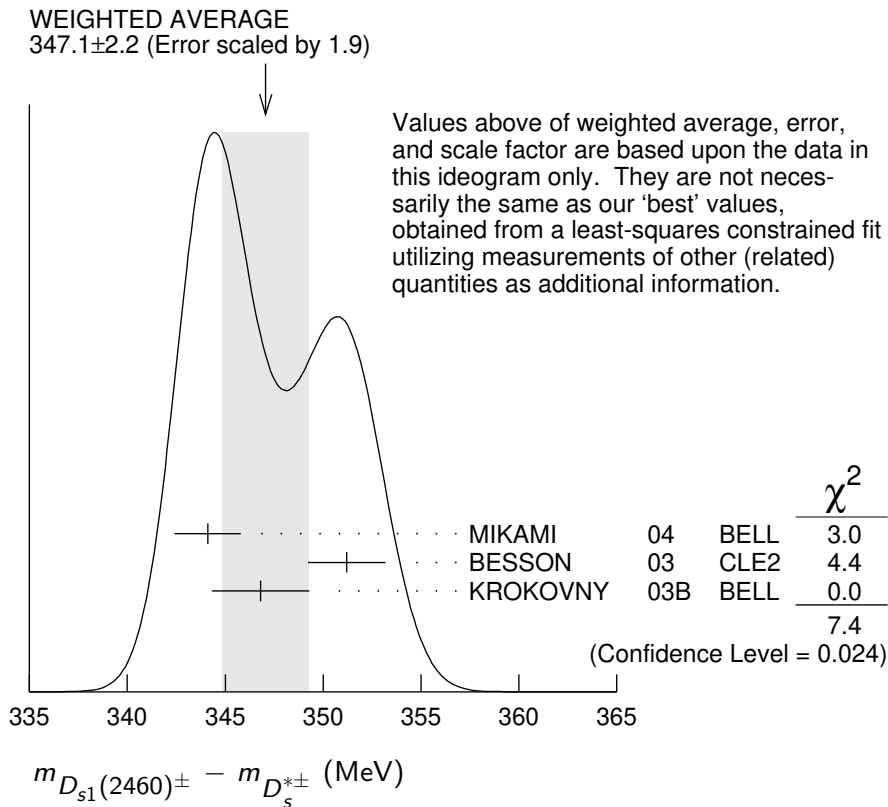
¹ The average of the values obtained from the $D_s^+ \gamma, D_s^+ \pi^0 \gamma, D_s^+ \pi^+ \pi^-$ final state.
² Systematic errors not evaluated. From the decay to $D_s^{*+} \pi^0$.
³ Systematic errors not evaluated. From the decay to $D_s^+ \gamma$.
⁴ Not independent of the corresponding $m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}}$.
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^{*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
491.1±0.6 OUR FIT	Error includes scale factor of 1.1.			
491.3±1.4 OUR AVERAGE				
491.0±1.3±1.9	152	⁹ MIKAMI	04 BELL	10.6 e^+e^-
491.4±0.9±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	BESSION	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 ^{+5.0} _{-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 $B \rightarrow D_{s1}(2460)^- \bar{D}^*$

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

seen 41 BESSION 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	$B \rightarrow D_{s1}(2460)^- \bar{D}^{(*)}$	
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 ^{*-} π ⁰) and B(D _s ⁻ γ).					

$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma(D_s^{*+} \pi^0)$				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	CL%	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.)
BESSION	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.)