

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

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

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.

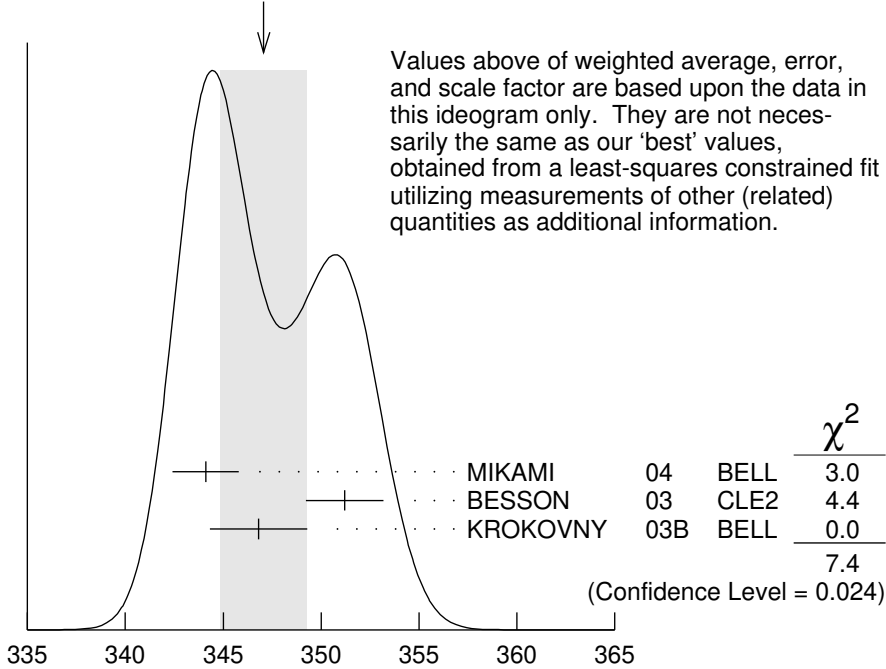
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2459.5±0.6 OUR FIT		Error includes scale factor of 1.1.		
2459.6±0.9 OUR AVERAGE		Error includes scale factor of 1.3.		
2460.1±0.2±0.8		¹ AUBERT	06P BABR	10.6 e^+e^-
2458.0±1.0±1.0	195	AUBERT	04E BABR	10.6 e^+e^-
● ● ● We do not use the following data for averages, 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^-

WEIGHTED AVERAGE
 347.1 ± 2.2 (Error scaled by 1.9)



⁸ Recalculated by us using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.

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

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

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 ± 0.6 OUR FIT	Error includes scale factor of 1.1.			
491.3 ± 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 \pm 11) %	
Γ_2 $D_s^+ \gamma$	(18 \pm 4) %	
Γ_3 $D_s^+ \pi^+ \pi^-$	(4.3 \pm 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 $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, 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 \pm 0.11 OUR FIT**0.56 \pm 0.13 \pm 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 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 \pm 0.04 OUR FIT**0.16 \pm 0.04 \pm 0.03** ¹² AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^- \bar{D}^*$ ¹² Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.

$$\Gamma(D_s^+ \gamma) / \Gamma(D_s^{*+} \pi^0) \quad \Gamma_2 / \Gamma_1$$

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 → D _{s1} (2460) ⁺ D ^(*)
< 0.49		90	BESSON	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).					

$$\Gamma(D_s^+ \pi^+ \pi^-) / \Gamma(D_s^{*+} \pi^0) \quad \Gamma_3 / \Gamma_1$$

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	BESSON	03	CLE2 10.6 e ⁺ e ⁻

$$\Gamma(D_s^{*+} \gamma) / \Gamma(D_s^{*+} \pi^0) \quad \Gamma_4 / \Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.16	90	BESSON	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 ⁻

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

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	BESSON	03	CLE2 10.6 e ⁺ e ⁻

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

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

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

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

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

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 ⁻

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

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.)