

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

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

### $D_{s1}(2460)^\pm$ 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
<b>2459.5±0.6 OUR FIT</b>		Error includes scale factor of 1.1.		
<b>2459.6±0.9 OUR AVERAGE</b>		Error includes scale factor of 1.3.		
2460.1±0.2±0.8		<sup>1</sup> 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	<sup>2</sup> AUBERT,B	04S BABR	$B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$
2461.1±1.6	139	<sup>3</sup> AUBERT,B	04S BABR	$B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$
2456.5±1.3±1.3	126	<sup>4,5</sup> MIKAMI	04 BELL	10.6 $e^+e^-$
2459.5±1.3±2.0	152	<sup>6,7</sup> MIKAMI	04 BELL	10.6 $e^+e^-$
2459.9±0.9±1.6	60	<sup>6,7</sup> MIKAMI	04 BELL	10.6 $e^+e^-$
2459.2±1.6±2.0	57	KROKOVNY	03B BELL	10.6 $e^+e^-$

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

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

<sup>3</sup> Systematic errors not evaluated. From the decay to  $D_s^+ \gamma$ .

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

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

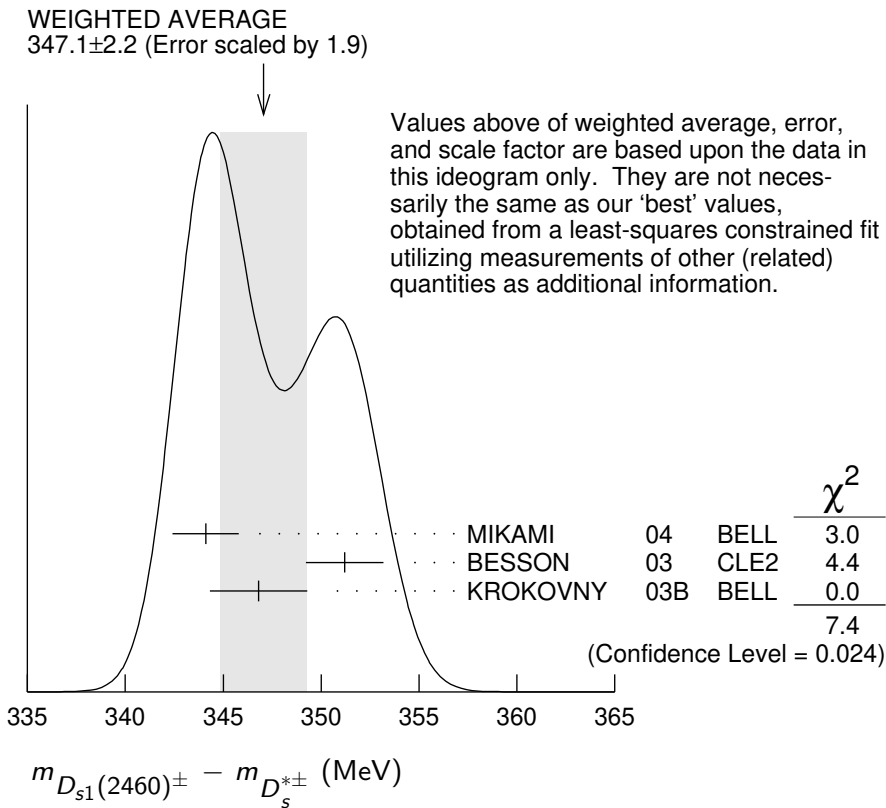
<sup>6</sup> Not independent of the corresponding  $m_{D_{s1}(2460)^\pm} - m_{D_s^\pm}$ .

<sup>7</sup> 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
<b>347.3±0.7 OUR FIT</b>		Error includes scale factor of 1.2.		
<b>347.1±2.2 OUR AVERAGE</b>		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	<sup>8</sup> KROKOVNY	03B BELL	10.6 $e^+e^-$
<sup>8</sup> 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  $D^{\pm}$ ,  $D^0$ ,  $D_s^{\pm}$ ,  $D_s^{*\pm}$ ,  $D^{*0}$ ,  $D_s^{*0}$ ,  $D_1(2420)^0$ ,  $D_2^*(2460)^0$ , and  $D_{s1}(2536)^{\pm}$  mass and mass difference measurements.

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

<sup>9</sup> From the decay to  $D_s^{\pm} \gamma$ .

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

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

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<b>&lt; 3.5</b>	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 ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level
$\Gamma_1$ $D_s^{*+} \pi^0$	(48 $\pm$ 11 ) %	
$\Gamma_2$ $D_s^+ \gamma$	(18 $\pm$ 4 ) %	
$\Gamma_3$ $D_s^+ \pi^+ \pi^-$	( 4.3 $\pm$ 1.3 ) %	S=1.1
$\Gamma_4$ $D_s^{*+} \gamma$	< 8 %	CL=90%
$\Gamma_5$ $D_{s0}^*(2317)^+ \gamma$	( 3.7 $^{+5.0}_{-2.4}$ ) %	
$\Gamma_6$ $D_s^+ \pi^0$		
$\Gamma_7$ $D_s^+ \pi^0 \pi^0$		
$\Gamma_8$ $D_s^+ \gamma \gamma$		

### 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

$\Gamma(D_s^{*+} \pi^0) / \Gamma_{\text{total}}$   $\Gamma_1 / \Gamma$

VALUE      EVTS      DOCUMENT ID      TECN      COMMENT

**0.48  $\pm$  0.11 OUR FIT**

**0.56  $\pm$  0.13  $\pm$  0.09**      <sup>11</sup> 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  $e^+ e^-$

<sup>11</sup> Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.

$\Gamma(D_s^+ \gamma) / \Gamma_{\text{total}}$   $\Gamma_2 / \Gamma$

VALUE      DOCUMENT ID      TECN      COMMENT

**0.18  $\pm$  0.04 OUR FIT**

**0.16  $\pm$  0.04  $\pm$  0.03**      <sup>12</sup> AUBERT      06N BABR  $B \rightarrow D_{s1}(2460)^- \bar{D}^*$

<sup>12</sup> 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
<b>0.38 ± 0.05</b>					<b>OUR FIT</b>
<b>0.44 ± 0.09</b>					<b>OUR AVERAGE</b>
0.55 ± 0.13 ± 0.08		152	MIKAMI 04	BELL	10.6 e <sup>+</sup> e <sup>-</sup>
0.38 ± 0.11 ± 0.04		38	KROKOVNY 03B	BELL	10.6 e <sup>+</sup> e <sup>-</sup>
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.274 ± 0.045 ± 0.020		251	<sup>13</sup> AUBERT,B 04s	BABR	B → D <sub>s1</sub> (2460) <sup>+</sup> D <sup>(*)</sup>
< 0.49		90	BESSION 03	CLE2	10.6 e <sup>+</sup> e <sup>-</sup>
<sup>13</sup> Used by AUBERT 06N in their measurement of B(D <sub>s</sub> <sup>*-</sup> π <sup>0</sup> ) and B(D <sub>s</sub> <sup>-</sup> γ).					

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

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

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt; 0.16</b>	90	BESSION 03	CLE2	10.6 e <sup>+</sup> e <sup>-</sup>
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.31	90	MIKAMI 04	BELL	10.6 e <sup>+</sup> e <sup>-</sup>

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

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.93 ± 0.09</b>			<b>OUR FIT</b>
<b>0.97 ± 0.09 ± 0.05</b>	AUBERT 06P	BABR	10.6 e <sup>+</sup> e <sup>-</sup>

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.35 ± 0.04</b>			<b>OUR FIT</b>
<b>0.337 ± 0.036 ± 0.038</b>	AUBERT 06P	BABR	10.6 e <sup>+</sup> e <sup>-</sup>

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

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.083 ± 0.017</b>			<b>OUR FIT</b>
<b>0.077 ± 0.013 ± 0.008</b>	AUBERT 06P	BABR	10.6 e <sup>+</sup> e <sup>-</sup>

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt; 0.24</b>	95	AUBERT 06P	BABR	10.6 e <sup>+</sup> e <sup>-</sup>

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

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