

$D_2^*(2460)^0$ 

$$I(J^P) = \frac{1}{2}(2^+)$$

$J^P = 2^+$  assignment strongly favored (ALBRECHT 89B, ALBRECHT 89H), natural parity confirmed by the helicity analysis (DEL-AMO-SANCHEZ 10P). AAIJ 13CC confirms  $J^P = 2^+$  and natural parity.

### $D_2^*(2460)^0$ 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>2460.7 ± 0.4 OUR FIT</b>	Error includes scale factor of 3.1.			
<b>2460.56 ± 0.35 OUR AVERAGE</b>	Error includes scale factor of 2.6. See the ideogram below.			
2463.7 ± 0.4 ± 0.7	28k	<sup>1</sup> AAIJ	16AH LHCb	$B^- \rightarrow D^+ \pi^- \pi^-$
2460.4 ± 0.4 ± 1.2	82k	AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
2460.4 ± 0.1 ± 0.1	675k	AAIJ	13CC LHCb	$pp \rightarrow D^+ \pi^- X$
2462.5 ± 2.4 $\begin{smallmatrix} +1.3 \\ -1.1 \end{smallmatrix}$	2.3k	<sup>2</sup> ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2462.2 ± 0.1 ± 0.8	243k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^+ \pi^- X$
2460.4 ± 1.2 ± 2.2	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
2461.6 ± 2.1 ± 3.3		<sup>3</sup> ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.5 ± 1.1 ± 1.9	5.8k	<sup>3</sup> LINK	04A FOCS	$\gamma A$
2465 ± 3 ± 3	486	AVERY	94C CLE2	$e^+ e^- \rightarrow D^+ \pi^- X$
2453 ± 3 ± 2	128	FRABETTI	94B E687	$\gamma Be \rightarrow D^+ \pi^- X$
2461 ± 3 ± 1	440	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2455 ± 3 ± 5	337	ALBRECHT	89B ARG	$e^+ e^- \rightarrow D^+ \pi^- X$
2459 ± 3 ± 2	153	ANJOS	89C TPS	$\gamma N \rightarrow D^+ \pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2469.1 ± 3.7 $\begin{smallmatrix} +1.2 \\ -1.3 \end{smallmatrix}$	1.5k	<sup>4</sup> CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2463.3 ± 0.6 ± 0.8	20k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^+ \pi^- X$
2461 ± 6	126	<sup>5</sup> ABREU	98M DLPH	$e^+ e^-$
2466 ± 7	1	ASRATYAN	95 BEBC	53,40 $\nu(\bar{\nu}) \rightarrow pX, dX$

<sup>1</sup> From the amplitude analysis in the model describing the  $D^+ \pi^-$  wave together with virtual contributions from the  $D^*(2007)^0$  and  $B^{*0}$  states, and components corresponding to the  $D_2^*(2460)^0, D_1^*(2680)^0, D_3^*(2760)^0$ , and  $D_2^*(3000)^0$  resonances.

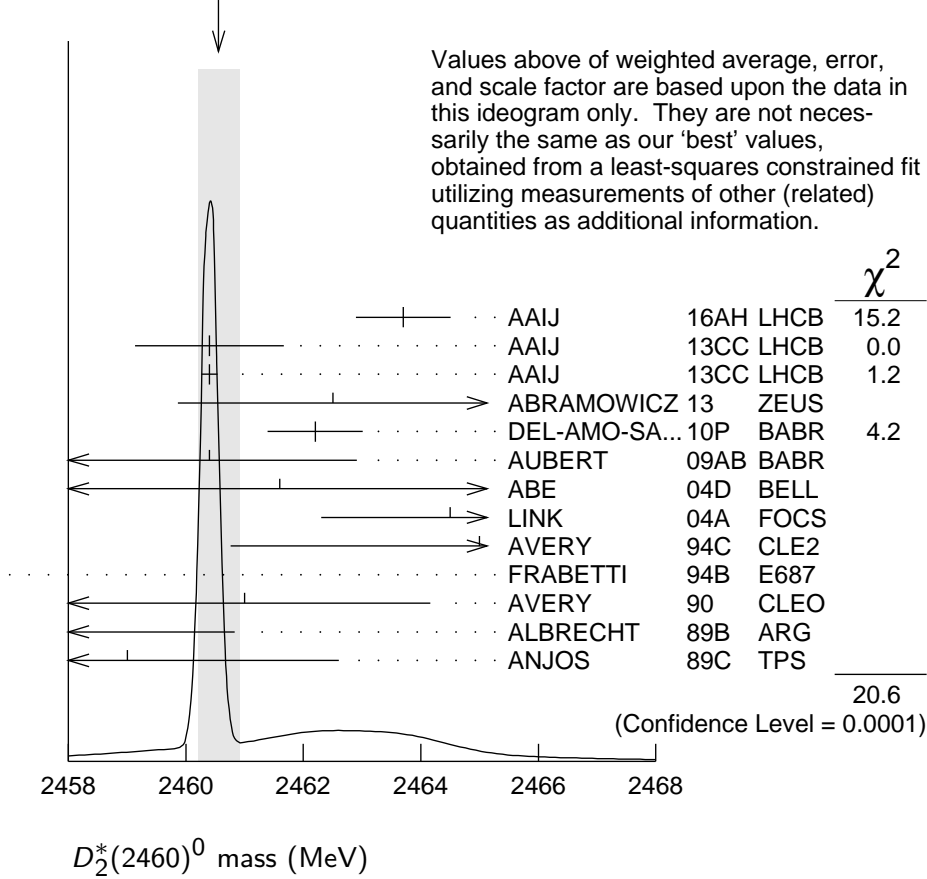
<sup>2</sup> From the combined fit of the  $M(D^+ \pi^-)$  and  $M(D^{*+} \pi^-)$  distributions. and  $A_{D_2}$  fixed to the theoretical prediction of  $-1$ .

<sup>3</sup> Fit includes the contribution from  $D_0^*(2400)^0$ .

<sup>4</sup> Calculated using the mass difference  $m(D_2^{*0}) - m(D^{*+})_{PDG}$  reported below and  $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$  MeV. The 0.17 MeV uncertainty of the PDG mass value should be added to the experimental uncertainty of  $\begin{smallmatrix} +1.2 \\ -1.3 \end{smallmatrix}$  MeV.

<sup>5</sup> No systematic error given.

WEIGHTED AVERAGE  
 $2460.56 \pm 0.35$  (Error scaled by 2.6)



### $m_{D_2^{*0}} - m_{D^+}$

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><math>591.0 \pm 0.4</math> OUR FIT</b>	Error includes scale factor of 2.9.			
<b><math>593.9 \pm 0.6 \pm 0.5</math></b>	20k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^+ \pi^- X$

### $m_{D_2^{*0}} - m_{D^{*+}}$

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><math>450.4 \pm 0.4</math> OUR FIT</b>	Error includes scale factor of 2.9.			
<b><math>458.8 \pm 3.7^{+1.2}_{-1.3}</math></b>	$1560 \pm 230$	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$

**$D_2^*(2460)^0$  WIDTH**

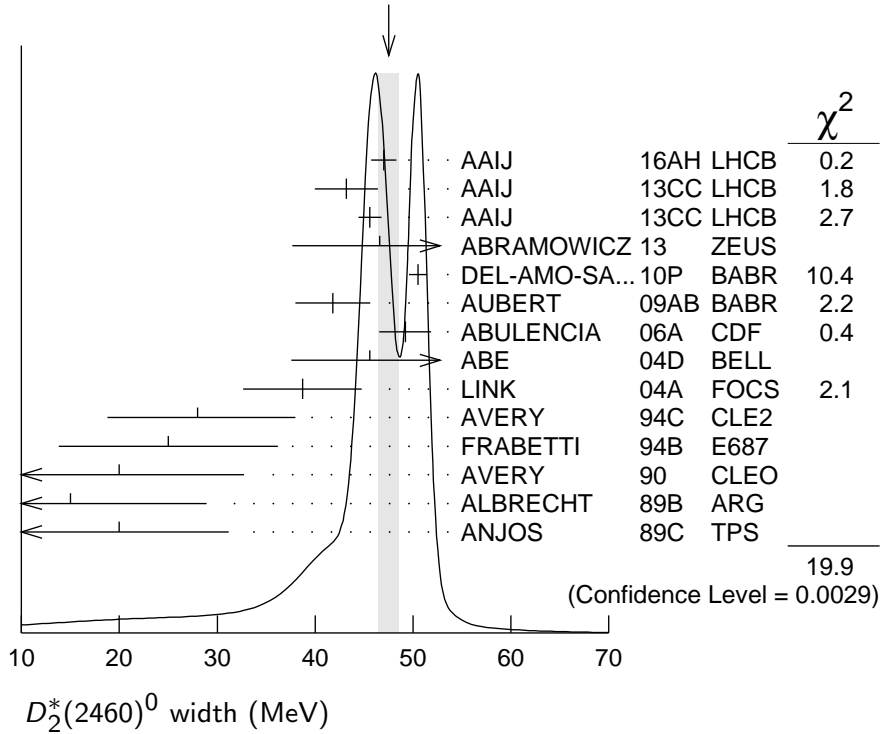
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>47.5 \pm 1.1</math></b>	<b>OUR AVERAGE</b>	Error includes scale factor of 1.8. See the ideogram below.		
$47.0 \pm 0.8 \pm 1.0$	28k	<sup>6</sup> AAIJ	16AH LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
$43.2 \pm 1.2 \pm 3.0$	82k	AAIJ	13CC LHCB	$p p \rightarrow D^{*+} \pi^- X$
$45.6 \pm 0.4 \pm 1.1$	675k	AAIJ	13CC LHCB	$p p \rightarrow D^+ \pi^- X$
$46.6 \pm 8.1 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 5.9 \\ 3.8 \end{smallmatrix}$	2.3k	<sup>7</sup> ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
$50.5 \pm 0.6 \pm 0.7$	243k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^+ \pi^- X$
$41.8 \pm 2.5 \pm 2.9$	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
$49.2 \pm 2.3 \pm 1.3$	20k	ABULENCIA	06A CDF	1900 $p \bar{p} \rightarrow D^+ \pi^- X$
$45.6 \pm 4.4 \pm 6.7$		<sup>8</sup> ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
$38.7 \pm 5.3 \pm 2.9$	5.8k	<sup>8</sup> LINK	04A FOCS	$\gamma A$
$28 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 8 \\ 7 \end{smallmatrix} \pm 6$	486	AVERY	94C CLE2	$e^+ e^- \rightarrow D^+ \pi^- X$
$25 \pm 10 \pm 5$	128	FRABETTI	94B E687	$\gamma \text{Be} \rightarrow D^+ \pi^- X$
$20 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 9 \\ 12 \end{smallmatrix} \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 9 \\ 10 \end{smallmatrix}$	440	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$15 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 13 \\ 10 \end{smallmatrix} \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 5 \\ 10 \end{smallmatrix}$	337	ALBRECHT	89B ARG	$e^+ e^- \rightarrow D^+ \pi^- X$
$20 \pm 10 \pm 5$	153	ANJOS	89C TPS	$\gamma N \rightarrow D^+ \pi^- X$

<sup>6</sup> From the amplitude analysis in the model describing the  $D^+ \pi^-$  wave together with virtual contributions from the  $D^*(2007)^0$  and  $B^{*0}$  states, and components corresponding to the  $D_2^*(2460)^0$ ,  $D_1^*(2680)^0$ ,  $D_3^*(2760)^0$ , and  $D_2^*(3000)^0$  resonances.

<sup>7</sup> From the combined fit of the  $M(D^+ \pi^-)$  and  $M(D^{*+} \pi^-)$  distributions. and  $A_{D_2}$  fixed to the theoretical prediction of  $-1$ .

<sup>8</sup> Fit includes the contribution from  $D_0^*(2400)^0$ .

WEIGHTED AVERAGE  
 $47.5 \pm 1.1$  (Error scaled by 1.8)



### $D_2^*(2460)^0$ DECAY MODES

$\bar{D}_2^*(2460)^0$  modes are charge conjugates of modes below.

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $D^+ \pi^-$	seen
$\Gamma_2$ $D^*(2010)^+ \pi^-$	seen
$\Gamma_3$ $D^0 \pi^+ \pi^-$	not seen
$\Gamma_4$ $D^{*0} \pi^+ \pi^-$	not seen

### $D_2^*(2460)^0$ BRANCHING RATIOS

$\Gamma(D^+ \pi^-)/\Gamma_{\text{total}}$					$\Gamma_1/\Gamma$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	3.4k	AUBERT 09AB BABR		$B^- \rightarrow D^+ \pi^- \pi^-$	
seen	337	ALBRECHT 89B ARG		$e^+ e^- \rightarrow D^+ \pi^- X$	
seen		ANJOS 89C TPS		$\gamma N \rightarrow D^+ \pi^- X$	

$\Gamma(D^*(2010)^+ \pi^-)/\Gamma_{\text{total}}$				$\Gamma_2/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	ACKERSTAFF 97W	OPAL	$e^+ e^- \rightarrow D^{*+} \pi^- X$	
seen	AVERY 90	CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$	
seen	ALBRECHT 89H	ARG	$e^+ e^- \rightarrow D^* \pi^- X$	

$$\Gamma(D^+\pi^-)/\Gamma(D^*(2010)^+\pi^-) \qquad \Gamma_1/\Gamma_2$$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1.54±0.15 OUR AVERAGE</b>				
1.4 ±0.3 ±0.3	2.3k	<sup>9</sup> ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+}\pi^- X$
1.47±0.03±0.16	379k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^- X$
2.8 ±0.8 $\begin{smallmatrix} +0.5 \\ -0.6 \end{smallmatrix}$	1560 ±230	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{(*)+}\pi^- X$
2.2 ±0.7 ±0.6		AVERY	94C CLE2	$e^+e^- \rightarrow D^{*+}\pi^- X$
2.3 ±0.8		AVERY	90 CLEO	$e^+e^-$
3.0 ±1.1 ±1.5		ALBRECHT	89H ARG	$e^+e^- \rightarrow D^*\pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.9 ±0.5		ABE	04D BELL	$B^- \rightarrow D^{(*)+}\pi^- \pi^-$

<sup>9</sup> From the combined fit of the  $M(D^+\pi^-)$  and  $M(D^{*+}\pi^-)$  distributions. and  $A_{D_2}$  fixed to the theoretical prediction of  $-1$ .

$$\Gamma(D^+\pi^-)/[\Gamma(D^+\pi^-) + \Gamma(D^*(2010)^+\pi^-)] \qquad \Gamma_1/(\Gamma_1+\Gamma_2)$$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.62±0.03±0.02	8414	<sup>10</sup> AUBERT	09Y BABR	$B^+ \rightarrow D_2^{*0}\ell^+\nu_\ell$

<sup>10</sup> Assuming  $\Gamma(\Upsilon(4S) \rightarrow B^+B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0\bar{B}^0) = 1.065 \pm 0.026$  and equal partial widths for charged and neutral  $D_2^*$  mesons.

### $D_2^*(2460)^0$ POLARIZATION AMPLITUDE $A_{D_2}$

A polarization amplitude  $A_{D_2}$  is a parameter that depends on the initial polarization of the  $D_2$ . For  $D_2$  decays the helicity angle,  $\theta_H$ , distribution varies like  $1 + A_{D_2} \cos^2(\theta_H)$ , where  $\theta_H$  is the angle in the  $D^*$  rest frame between the two pions emitted by the  $D_2 \rightarrow D^*\pi$  and  $D^* \rightarrow D\pi$ .

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
-1.16±0.35	2.3k	<sup>11</sup> ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+}\pi^- X$
consistent with $-1$	243k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^+\pi^- X$
-0.74 $\begin{smallmatrix} +0.49 \\ -0.38 \end{smallmatrix}$		<sup>12</sup> AVERY	94C CLE2	$e^+e^- \rightarrow D^{*+}\pi^- X$

<sup>11</sup> From the combined fit of the  $M(D^+\pi^-)$  and  $M(D^{*+}\pi^-)$  distributions.

<sup>12</sup> Systematic uncertainties not estimated.

### $D_2^*(2460)^0$ REFERENCES

AAIJ	16AH PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13CC JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABRAMOWICZ	13 NP B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
DEL-AMO-SA...	10P PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT	09AB PR D79 112004	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09Y PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHEKANOV	09 EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABULENCIA	06A PR D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABE	04D PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)
LINK	04A PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)

ABREU	98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ASRATYAN	95	ZPHY C68 43	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)
AVERY	94C	PL B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)
ALBRECHT	89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP
ALBRECHT	89H	PL B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP
ANJOS	89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)

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