

$D_2^*(2460)$

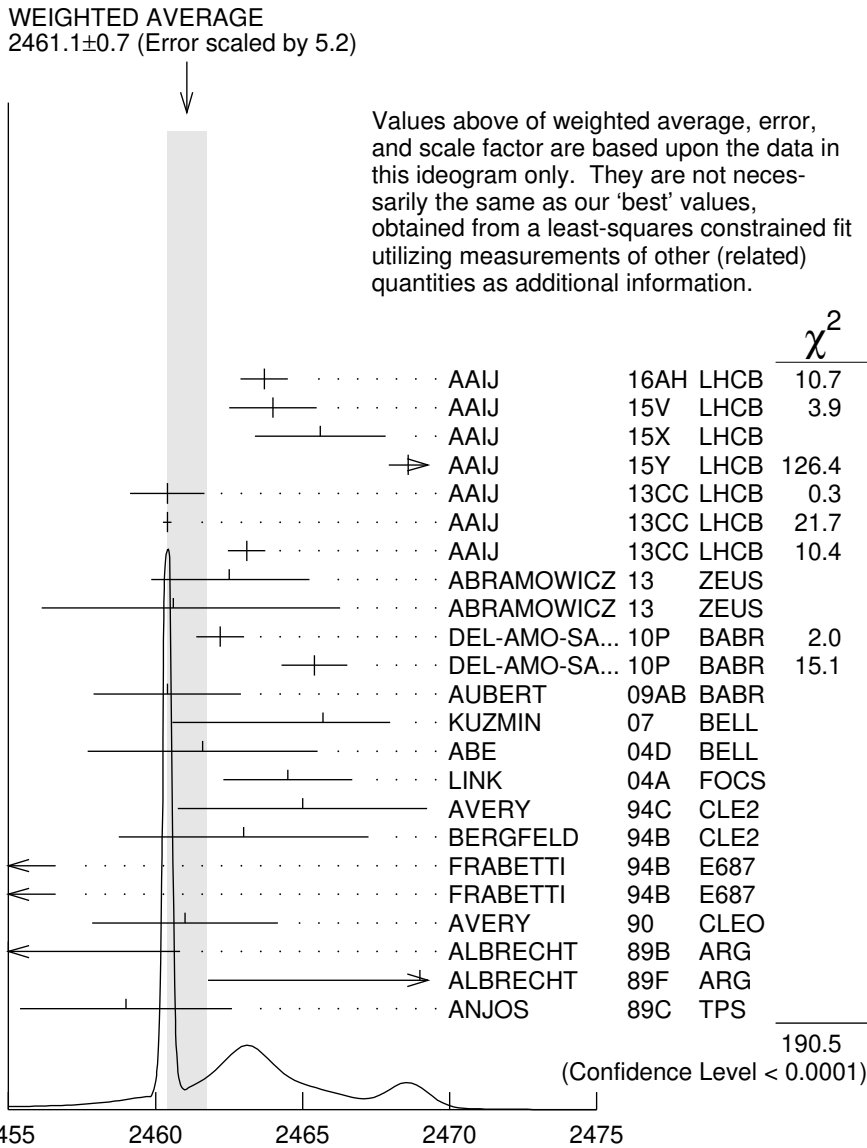
$$I(J^P) = \frac{1}{2}(2^+)$$

$D_2^*(2460)$ 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	CHG	COMMENT
2461.1±0.8 OUR FIT		Error includes scale factor of 6.3.			
2461.1±0.7 OUR AVERAGE		Error includes scale factor of 5.2. See the ideogram below.			
2463.7±0.4±0.7	28k	¹ AAIJ	16AH LHCb	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.0±1.4±0.5	2k	² AAIJ	15V LHCb	0	$B^- \rightarrow D^+ K^- \pi^-$
2465.6±1.8±1.3		³ AAIJ	15X LHCb	+	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
2468.6±0.6±0.3		⁴ AAIJ	15Y LHCb	+	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2460.4±0.4±1.2	82k	AAIJ	13CC LHCb	0	$pp \rightarrow D^{*+} \pi^- X$
2460.4±0.1±0.1	675k	AAIJ	13CC LHCb	0	$pp \rightarrow D^+ \pi^- X$
2463.1±0.2±0.6	342k	AAIJ	13CC LHCb	+	$pp \rightarrow D^0 \pi^+ X$
2462.5±2.4 ^{+1.3} _{-1.1}	2.3k	⁵ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2460.6±4.4 ^{+3.6} _{-0.8}	1371	⁶ ABRAMOWICZ13	ZEUS	+	$e^\pm p \rightarrow D^{(*)0} \pi^+ X$
2462.2±0.1±0.8	243k	DEL-AMO-SA...10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2465.4±0.2±1.1	111k	⁷ DEL-AMO-SA...10P	BABR	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
2460.4±1.2±2.2	3.4k	AUBERT	09AB BABR	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2465.7±1.8 ^{+1.4} _{-4.8}	2909	KUZMIN	07 BELL	+	$e^+ e^- \rightarrow \text{hadrons}$
2461.6±2.1±3.3		⁸ ABE	04D BELL	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.5±1.1±1.9	5.8k	⁸ LINK	04A FOCS	0	γA
2465 ±3 ±3	486	AVERY	94C CLE2	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2463 ±3 ±3	310	BERGFELD	94B CLE2	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
2453 ±3 ±2	128	FRABETTI	94B E687	0	$\gamma \text{Be} \rightarrow D^+ \pi^- X$
2453 ±3 ±2	185	FRABETTI	94B E687	+	$\gamma \text{Be} \rightarrow D^0 \pi^+ X$
2461 ±3 ±1	440	AVERY	90 CLEO	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2455 ±3 ±5	337	ALBRECHT	89B ARG	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2469 ±4 ±6		ALBRECHT	89F ARG	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
2459 ±3 ±2	153	ANJOS	89C TPS	0	$\gamma N \rightarrow D^+ \pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2468.1±0.6±0.5		⁹ AAIJ	15Y LHCb	+	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2469.1±3.7 ^{+1.2} _{-1.3}	1.5k	¹⁰ CHEKANOV	09 ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2463.3±0.6±0.8	20k	ABULENCIA	06A CDF	0	1900 $p\bar{p} \rightarrow D^+ \pi^- X$
2467.6±1.5±0.8	3.5k	¹¹ LINK	04A FOCS	+	γA
2461 ±6	126	¹² ABREU	98M DLPH	0	$e^+ e^-$
2466 ±7	1	ASRATYAN	95 BEBC	0	53,40 $\nu(\bar{\nu}) \rightarrow pX, dX$

¹From 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.



$D_2^*(2460)$ mass (MeV)

- ² 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, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.
- ³ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S -wave and the $D\pi$ S - and P -waves.
- ⁴ Modeling the $\pi^+\pi^-$ S -wave with the Isobar formalism.
- ⁵ 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 .
- ⁶ From the fit of the $M(D^0\pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1 , respectively.
- ⁷ At a fixed width of 50.5 MeV.
- ⁸ Fit includes the contribution from $D_0^*(2400)^0$.

⁹ Modeling the $\pi^+\pi^-$ S-wave with the K-matrix formalism.

¹⁰ 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 ${}_{-1.3}^{+1.2}$ MeV.

¹¹ Fit includes the contribution from $D_0^*(2400)^\pm$. Not independent of the corresponding mass difference measurement, $(m_{D_2^*(2460)^\pm}) - (m_{D_2^*(2460)^0})$.

¹² No systematic error given.

$m_{D_2^*(2460)^0} - m_{D^+}$

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
591.5±0.8 OUR FIT	Error includes scale factor of 6.0.			
593.9±0.6±0.5	20k	ABULENCIA	06A	CDF 1900 $p\bar{p} \rightarrow D^+\pi^-X$

$m_{D_2^*(2460)^0} - m_{D^{*+}}$

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
450.9±0.8 OUR FIT	Error includes scale factor of 6.0.			
458.8±3.7${}_{-1.3}^{+1.2}$	1.5k	CHEKANOV	09	ZEUS $e^\pm p \rightarrow D^{(*)+}\pi^-X$

$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0}$

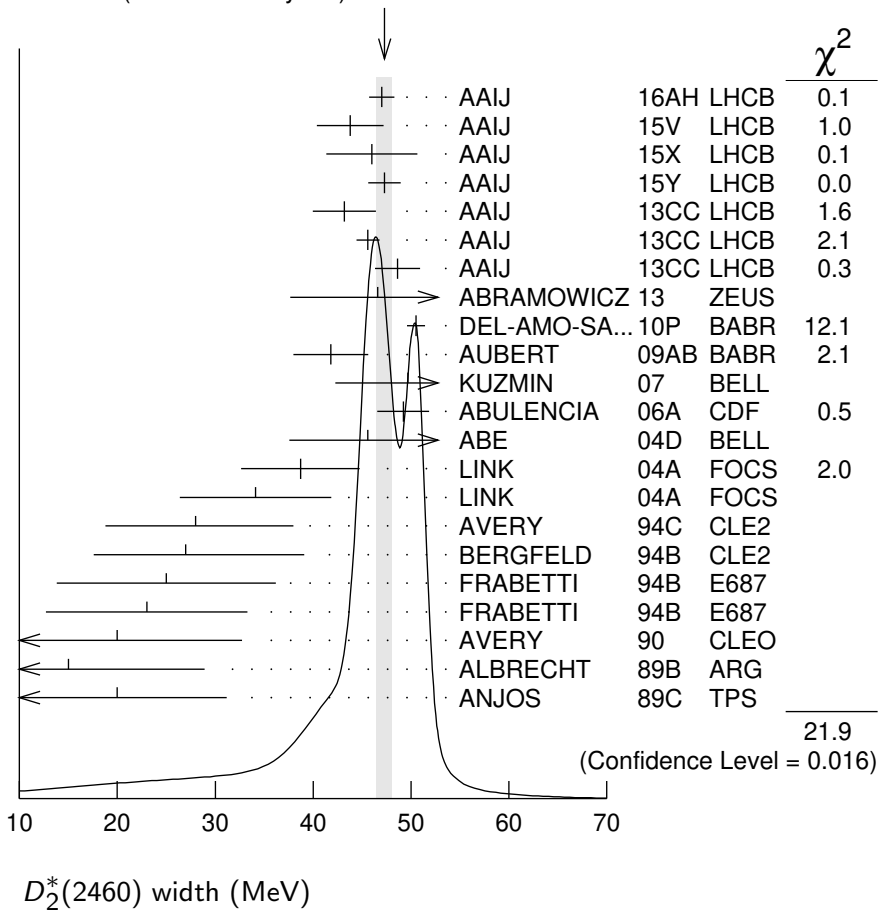
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2.4±1.7 OUR AVERAGE			
3.1±1.9±0.9	LINK	04A	FOCS γA
- 2 ±4 ±4	BERGFELD	94B	CLE2 $e^+e^- \rightarrow$ hadrons
0 ±4	FRABETTI	94B	E687 $\gamma Be \rightarrow D\pi X$
14 ±5 ±8	ALBRECHT	89F	ARG $e^+e^- \rightarrow D^0\pi^+X$

$D_2^*(2460)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
47.3± 0.8 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.					
47.0± 0.8± 1.0	28k	1 AAIJ	16AH	LHCB	0 $B^- \rightarrow D^+\pi^-\pi^-$	
43.8± 2.9± 1.8	2k	2 AAIJ	15V	LHCB	0 $B^- \rightarrow D^+K^-\pi^-$	
46.0± 3.4± 3.2		3 AAIJ	15X	LHCB	+	$B^0 \rightarrow \bar{D}^0K^+\pi^-$
47.3± 1.5± 0.7		4 AAIJ	15Y	LHCB	+	$B^0 \rightarrow \bar{D}^0\pi^+\pi^-$
43.2± 1.2± 3.0	82k	AAIJ	13CC	LHCB	0	$p p \rightarrow D^{*+}\pi^-X$
45.6± 0.4± 1.1	675k	AAIJ	13CC	LHCB	0	$p p \rightarrow D^+\pi^-X$
48.6± 1.3± 1.9	342k	AAIJ	13CC	LHCB	+	$p p \rightarrow D^0\pi^+X$

$46.6 \pm 8.1^{+5.9}_{-3.8}$	2.3k	5	ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$	
$50.5 \pm 0.6 \pm 0.7$	243k		DEL-AMO-SA...10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$	
$41.8 \pm 2.5 \pm 2.9$	3.4k		AUBERT	09AB	BABR	0	$B^- \rightarrow D^+ \pi^- \pi^-$
$49.7 \pm 3.8 \pm 6.4$	2909		KUZMIN	07	BELL	+	$e^+ e^- \rightarrow \text{hadrons}$
$49.2 \pm 2.3 \pm 1.3$	20k		ABULENCIA	06A	CDF	0	$1900 p \bar{p} \rightarrow D^+ \pi^- X$
$45.6 \pm 4.4 \pm 6.7$		6	ABE	04D	BELL	0	$B^- \rightarrow D^+ \pi^- \pi^-$
$38.7 \pm 5.3 \pm 2.9$	5.8k	6	LINK	04A	FOCS	0	γA
$34.1 \pm 6.5 \pm 4.2$	3.5k	7	LINK	04A	FOCS	+	γA
$28^{+8}_{-7} \pm 6$	486		AVERY	94C	CLE2	0	$e^+ e^- \rightarrow D^+ \pi^- X$
$27^{+11}_{-8} \pm 5$	310		BERGFELD	94B	CLE2	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
$25 \pm 10 \pm 5$	128		FRABETTI	94B	E687	0	$\gamma Be \rightarrow D^+ \pi^- X$
$23 \pm 9 \pm 5$	185		FRABETTI	94B	E687	+	$\gamma Be \rightarrow D^0 \pi^+ X$
$20^{+9}_{-12} \pm 9$	440		AVERY	90	CLEO	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$15^{+13}_{-10} \pm 5$	337		ALBRECHT	89B	ARG	0	$e^+ e^- \rightarrow D^+ \pi^- X$
$20 \pm 10 \pm 5$	153		ANJOS	89C	TPS	0	$\gamma N \rightarrow D^+ \pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●							
$46.0 \pm 1.4 \pm 1.8$		8	AAIJ	15Y	LHCB	+	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$

WEIGHTED AVERAGE
 47.3 ± 0.8 (Error scaled by 1.5)



¹ 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.

² 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, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

³ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S -wave and the $D\pi$ S - and P -waves.

⁴ Modeling the $\pi^+\pi^-$ S -wave with the Isobar formalism.

⁵ 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 .

⁶ Fit includes the contribution from $D_0^*(2400)^0$.

⁷ Fit includes the contribution from $D_0^*(2400)^\pm$.

⁸ Modeling the $\pi^+\pi^-$ S -wave with the K-matrix formalism.

$D_2^*(2460)$ DECAY MODES

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

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\pi^-$	seen
Γ_2 $D^*(2010)\pi^-$	seen
Γ_3 $D\pi^+\pi^-$	
Γ_4 $D^*\pi^+\pi^-$	

$D_2^*(2460)$ BRANCHING RATIOS

$\Gamma(D\pi^-)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	3.4k	AUBERT	09AB BABR	0	$B^- \rightarrow D^+\pi^-\pi^-$	
seen	337	ALBRECHT	89B ARG	0	$e^+e^- \rightarrow D^+\pi^-X$	
seen		ALBRECHT	89F ARG	+	$e^+e^- \rightarrow D^0\pi^+X$	
seen		ANJOS	89C TPS	0	$\gamma N \rightarrow D^+\pi^-X$	

$\Gamma(D^*(2010)\pi^-)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
seen	ACKERSTAFF 97W	OPAL	0	$e^+e^- \rightarrow D^{*+}\pi^-X$		
seen	AVERY 90	CLEO	0	$e^+e^- \rightarrow D^{*+}\pi^-X$		
seen	ALBRECHT 89H	ARG	0	$e^+e^- \rightarrow D^*\pi^-X$		

$\Gamma(D\pi^-)/\Gamma(D^*(2010)\pi^-)$						Γ_1/Γ_2
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
1.52 ± 0.14 OUR AVERAGE						
1.4 ± 0.3 ± 0.3	2.3k	¹ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+}\pi^-X$	
1.1 ± 0.4 $\begin{smallmatrix} +0.3 \\ -0.2 \end{smallmatrix}$	1371	² ABRAMOWICZ13	ZEUS	+	$e^\pm p \rightarrow D^{(*)0}\pi^+X$	
1.47 ± 0.03 ± 0.16	379k	DEL-AMO-SA..10P	BABR	0	$e^+e^- \rightarrow D^{(*)+}\pi^-X$	

$2.8 \pm 0.8 \begin{smallmatrix} +0.5 \\ -0.6 \end{smallmatrix}$	1.5k	CHEKANOV	09	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
$2.2 \pm 0.7 \pm 0.6$		AVERY	94C	CLE2	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$1.9 \pm 1.1 \pm 0.3$		BERGFELD	94B	CLE2	+	$e^+ e^- \rightarrow \text{hadrons}$
2.3 ± 0.8		AVERY	90	CLEO	0	$e^+ e^-$
$3.0 \pm 1.1 \pm 1.5$		ALBRECHT	89H	ARG	0	$e^+ e^- \rightarrow D^* \pi^- X$

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

1.9 ± 0.5		ABE	04D	BELL	0	$B^- \rightarrow D^{(*)+} \pi^- \pi^-$
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¹From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .
²From the fit of the $M(D^0 \pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1 , respectively.

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

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.62 \pm 0.03 \pm 0.02$	8414	¹ AUBERT	09Y	BABR	0	$B^+ \rightarrow D_2^{*0} \ell^+ \nu_\ell$
$0.62 \pm 0.03 \pm 0.02$	3361	¹ AUBERT	09Y	BABR	+	$\bar{B}^0 \rightarrow D_2^{*+} \ell^- \nu_\ell$

¹Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths for charged and neutral D_2^* mesons.

$D_2^*(2460)$ 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, θ_H , distribution varies like $1 + A_{D_2} \cos^2(\theta_H)$, where θ_H is the angle in the D^* rest frame between the two pions emitted by the $D_2 \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$.

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

-1.16 ± 0.35	2.3k	¹ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$	
consistent with -1	243k	DEL-AMO-SA...10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$	
$-0.74 \begin{smallmatrix} +0.49 \\ -0.38 \end{smallmatrix}$		² AVERY	94C	CLE2	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$

¹From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions.

²Systematic uncertainties not estimated.

$D_2^*(2460)$ REFERENCES

AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15V	PR D91 092002	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D93 119901 (errata.)	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15X	PR D92 012012	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15Y	PR D92 032002	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	R. 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.)

KUZMIN	07	PR D76 012006	A. Kuzmin <i>et al.</i>	(BELLE 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.)
BERGFELD	94B	PL B340 194	T. Bergfeld <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	89F	PL B231 208	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
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.)
