

$D_1(2420)^0$ $I(J^P) = \frac{1}{2}(1^+)$
 I needs confirmation. **$D_1(2420)^0$ 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.

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2421.4±0.6 OUR FIT	Error includes scale factor of 1.2.			
2421.1±0.7 OUR AVERAGE	Error includes scale factor of 1.2.			
2423.1±1.5 ^{+0.4} _{-1.0}	2.7k	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2420.1±0.1±0.8	103k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2426 ±3 ±1	151	ABE	05A BELL	$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
2421.4±1.5±0.9		² ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2421 ⁺¹ ₋₂ ±2	286	AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2422 ±2 ±2	51	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} \pi^- X$
2428 ±3 ±2	279	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2414 ±2 ±5	171	ALBRECHT	89H ARG	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2428 ±8 ±5	171	ANJOS	89C TPS	$\gamma N \rightarrow D^{*+} \pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2420.5±2.1±0.9	3110±340	³ CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
2421.7±0.7±0.6	7.5k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$
2425 ±3	235	⁴ ABREU	98M DLPH	$e^+ e^-$

¹ 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 .

² Fit includes the contribution from $D_1^*(2430)^0$.

³ Calculated using the mass difference $m(D_1^0) - m(D^{*+})_{PDG}$ 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 0.9 MeV.

⁴ No systematic error given.

 $m_{D_1^0} - m_{D^{*+}}$

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.

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
411.1±0.6 OUR FIT	Error includes scale factor of 1.2.			
411.5±0.8 OUR AVERAGE				
410.2±2.1±0.9	3110±340	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
411.7±0.7±0.4	7.5k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$

$D_1(2420)^0$ WIDTH

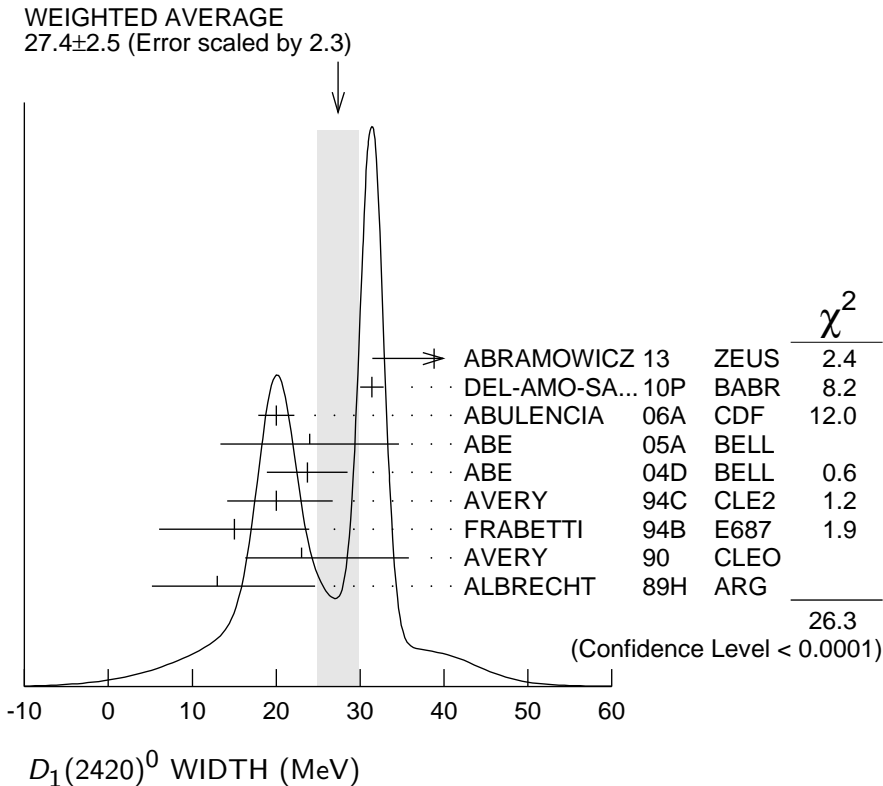
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
27.4 ± 2.5 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.			
38.8 ± 5.0 ^{+1.9} _{-5.4}	2.7k	⁵ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
31.4 ± 0.5 ± 1.3	103k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$
20.0 ± 1.7 ± 1.3	7.5k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$
24 ± 7 ± 8	151	ABE	05A BELL	$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
23.7 ± 2.7 ± 4.0		⁶ ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^- \pi^-$
20 ⁺⁶ ₋₅ ± 3	286	AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$
15 ± 8 ± 4	51	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} \pi^- X$
23 ⁺⁸ ₋₆ ⁺¹⁰ ₋₃	279	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
13 ± 6 ⁺¹⁰ ₋₅	171	ALBRECHT	89H ARG	$e^+ e^- \rightarrow D^{*+} \pi^- X$

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

53.2 ± 7.2 ^{+3.3} _{-4.9}	3110 ± 340	CHEKANOV	09	ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
58 ± 14 ± 10	171	ANJOS	89C	TPS	$\gamma N \rightarrow D^{*+} \pi^- X$

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 $D_1^*(2430)^0$.



$D_1(2420)^0$ DECAY MODES

$\bar{D}_1(2420)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^*(2010)^+ \pi^-$	seen
Γ_2 $D^0 \pi^+ \pi^-$	seen
Γ_3 $D^0 \rho^0$	
Γ_4 $D^0 f_0(500)$	
Γ_5 $D_0^*(2400)^+ \pi^-$	
Γ_6 $D^+ \pi^-$	not seen
Γ_7 $D^{*0} \pi^+ \pi^-$	not seen

$D_1(2420)^0$ BRANCHING RATIOS

$\Gamma(D^*(2010)^+ \pi^-)/\Gamma_{\text{total}}$				Γ_1/Γ
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	$e^+ e^- \rightarrow D^* \pi^- X$	
seen	ANJOS 89C	TPS	$\gamma N \rightarrow D^{*+} \pi^- X$	
$\Gamma(D^+ \pi^-)/\Gamma(D^*(2010)^+ \pi^-)$				Γ_6/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	90	AVERY 90	CLEO	$e^+ e^- \rightarrow D^+ \pi^- X$

$D_1(2420)^0$ POLARIZATION AMPLITUDE A_{D_1}

A polarization amplitude A_{D_1} is a parameter that depends on the initial polarization of the D_1 and is sensitive to a possible S -wave contribution to its decay. For D_1 decays the helicity angle, θ_h , distribution varies like $1 + A_{D_1} \cos^2 \theta_h$, where θ_h is the angle in the D^* rest frame between the two pions emitted by the $D_1 \rightarrow D^* \pi$ and the $D^* \rightarrow D \pi$.

Unpolarized D_1 decaying purely via D -wave is predicted to give $A_{D_1} = 3$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
5.73 ± 0.25 OUR AVERAGE				
7.8 $^{+6.7}_{-2.7}$ $^{+4.6}_{-1.8}$	2.7k	⁷ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
5.72 ± 0.25	103k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$
5.9 $^{+3.0}_{-1.7}$ $^{+2.4}_{-1.0}$		CHEKANOV 09	ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3.8 ± 0.6 ± 0.8		⁸ AUBERT 09Y	BABR	$B^+ \rightarrow D_1^0 \ell^+ \nu_\ell$
2.74 $^{+1.40}_{-0.93}$		⁹ AVERY 94C	CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$

⁷ 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 . A pure D -wave not excluded although some \bar{S} -wave mixing possible.

⁸ 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 and helicity angle distributions for charged and neutral D_1 mesons.

⁹ Systematic uncertainties not estimated.

$D_1(2420)^0$ REFERENCES

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 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 05A	PRL 94 221805	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE 04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE 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.)
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 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.)