

$D_1(2420)^0$

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

 $D_1(2420)^0$ 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.

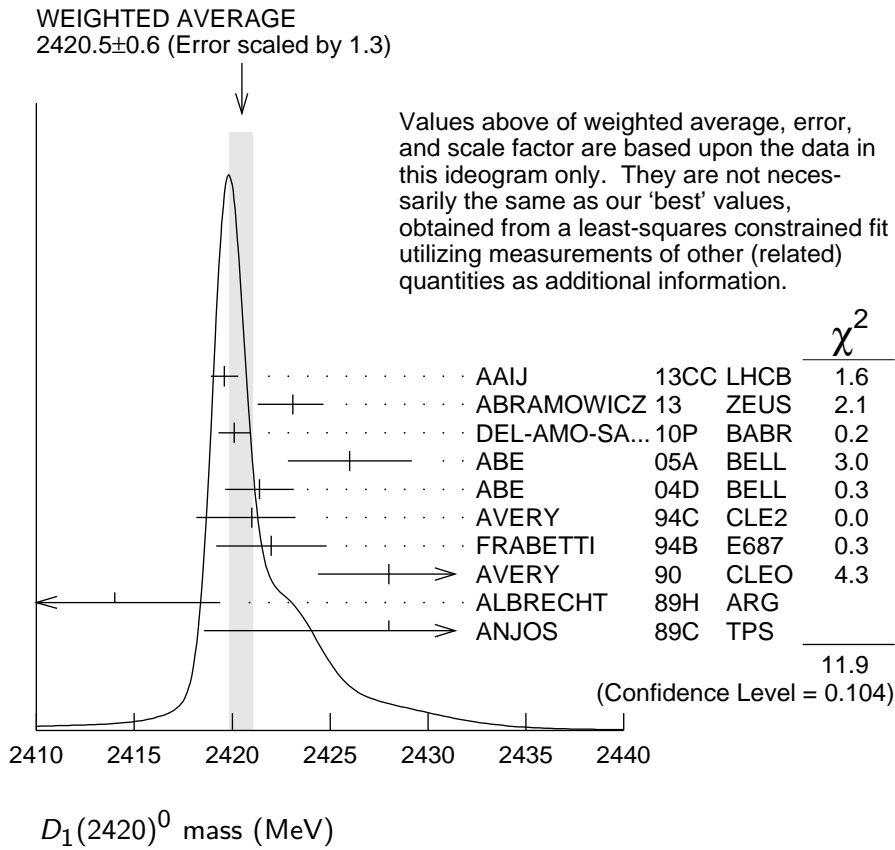
<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2420.8±0.5 OUR FIT	Error includes scale factor of 1.3.			
2420.5±0.6 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
2419.6±0.1±0.7	210k	AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
2423.1±1.5 ^{+0.4} _{-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	$e^+ e^-$

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 .

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

³Calculated 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.

⁴No 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.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
410.6±0.5 OUR FIT				Error includes scale factor of 1.3.
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
31.7± 2.5 OUR AVERAGE				Error includes scale factor of 3.5. See the ideogram below.
35.2± 0.4± 0.9	210k	AAIJ 13CC	LHCb	$p p \rightarrow D^{*+} \pi^- X$
38.8± 5.0 ⁺ ₋ 1.9 5.4	2.7k	¹ 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	$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$

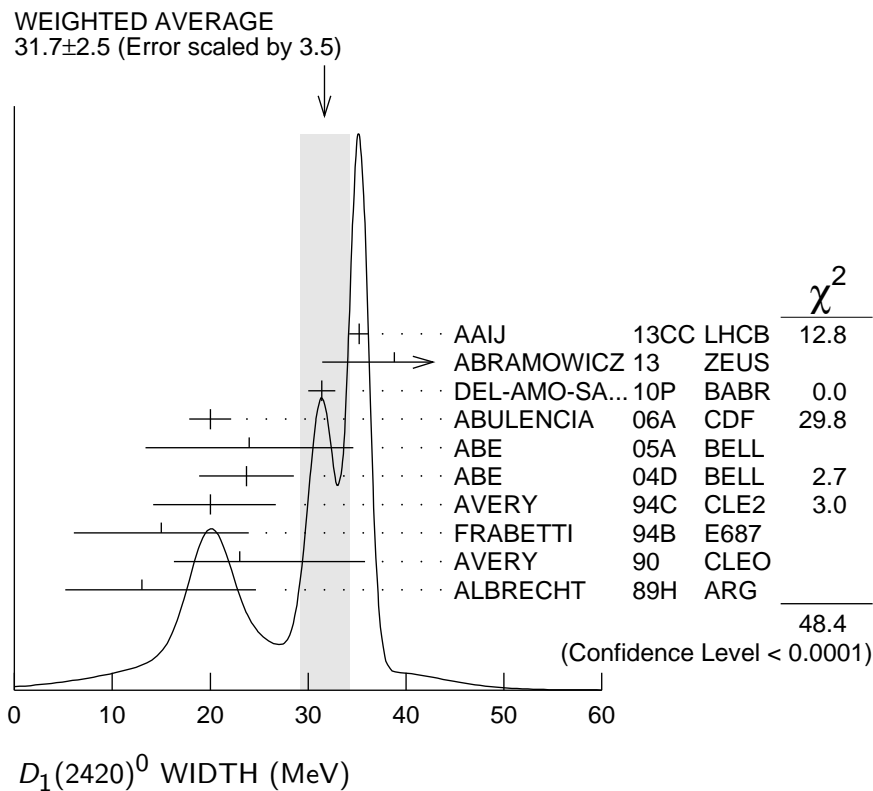
$23.7 \pm 2.7 \pm 4.0$		² ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^- \pi^-$
$20 \pm \frac{6}{5} \pm 3$	286	AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$15 \pm 8 \pm 4$	51	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} \pi^- X$
$23 \pm \frac{8}{6} \pm \frac{10}{3}$	279	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$13 \pm 6 \pm \frac{10}{5}$	171	ALBRECHT	89H ARG	$e^+ e^- \rightarrow D^{*+} \pi^- X$

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

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

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 $D_1^*(2430)^0$.



$D_1(2420)^0$ 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	$D_0^*(2300)^+ \pi^-$	
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	¹ 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. • • •				
3.30 ± 0.48	210k	² AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
3.8 ± 0.6 ± 0.8		³ AUBERT	09Y BABR	$B^+ \rightarrow D_1^0 \ell^+ \nu_\ell$
2.74 $^{+1.40}_{-0.93}$		⁴ AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$

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

² Systematic uncertainty not estimated. Resonance parameters fixed.

³ 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.

⁴ Systematic uncertainties not estimated.

$D_1(2420)^0$ REFERENCES

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	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.)
