$\pi_2(1670)$

$I^G(J^{PC}) = 1^-(2^{-+})$

$\pi_2(1670)$ MASS

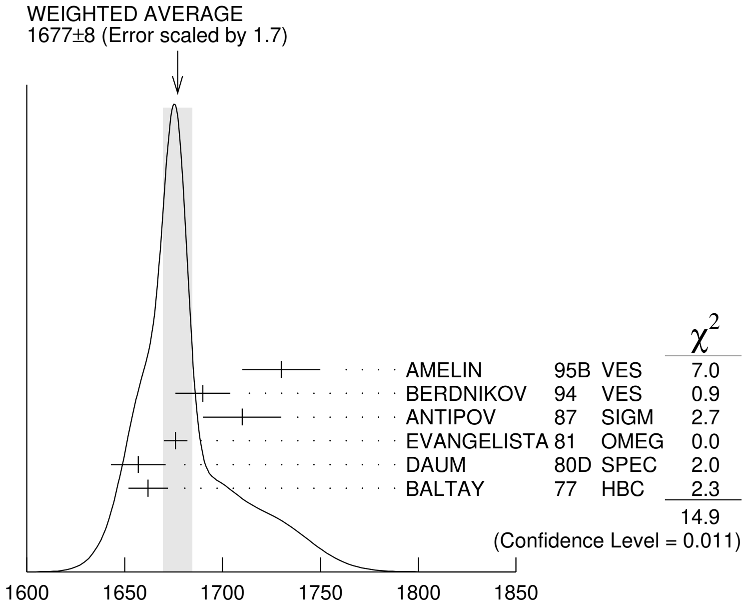
VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
1670±20 OUR ESTIMATE	This is only an educated guess; the error given is larger than the error on the average of the published values.					
1677± 8 OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.					
1730±20		[1] AMELIN	95B	VES		36 $\pi^- A \to \pi^+ \pi^- \pi^- A$
1690±14		[2] BERDNIKOV	94	VES		37 $\pi^- A \to K^+ K^- \pi^- A$
1710±20	700	ANTIPOV	87	SIGM	−	50 π^- Cu $\to \mu^+ \mu^- \pi^-$ Cu
1676± 6		[2] EVANGELISTA	81	OMEG	−	12 $\pi^- p \to 3\pi p$
1657±14		[2,3] DAUM	80D	SPEC	−	63–94 $\pi p \to 3\pi X$
1662±10	2000	[2] BALTAY	77	HBC	+	15 $\pi^+ p \to p 3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1742±31±49		ANTREASYAN	90	CBAL		$e^+ e^- \to e^+ e^- \pi^0 \pi^0 \pi^0$
1710±20		[4] DAUM	81B	SPEC	−	63,94 $\pi^- p$
1660±10		[2] ASCOLI	73	HBC	−	5–25 $\pi^- p \to p \pi_2$

[1] From a fit to $J^{PC} = 2^{-+}$ $f_2(1270)\pi$, $f_0(1370)\pi$ waves.

[2] From a fit to $J^P = 2^-$ S-wave $f_2(1270)\pi$ partial wave.

[3] Clear phase rotation seen in $2^- S$, $2^- P$, $2^- D$ waves. We quote central value and spread of single-resonance fits to three channels.

[4] From a two-resonance fit to four $2^- 0^+$ waves. This should not be averaged with all the single resonance fits.



$\pi_2(1670)$ mass (MeV)

$\pi_2(1670)$ WIDTH

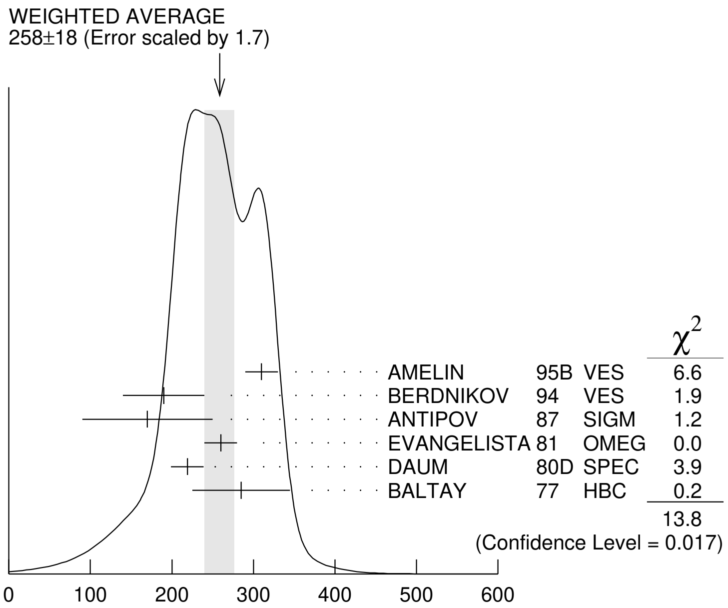
VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
258±18 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.				
310±20		[5] AMELIN	95B	VES		36 $\pi^- A \to \pi^+\pi^-\pi^- A$
190±50		[6] BERDNIKOV	94	VES		37 $\pi^- A \to K^+ K^- \pi^- A$
170±80	700	ANTIPOV	87	SIGM	−	50 π^- Cu $\to \mu^+\mu^-\pi^-$ Cu
260±20		[6] EVANGELISTA	81	OMEG	−	12 $\pi^- p \to 3\pi p$
219±20		[6,7] DAUM	80D	SPEC	−	63–94 $\pi p \to 3\pi X$
285±60	2000	[6] BALTAY	77	HBC	+	15 $\pi^+ p \to p 3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
236±49±36		ANTREASYAN	90	CBAL		$e^+e^- \to e^+e^-\pi^0\pi^0\pi^0$
312±50		[8] DAUM	81B	SPEC	−	63,94 $\pi^- p$
270±60		[6] ASCOLI	73	HBC	−	5–25 $\pi^- p \to p \pi_2$

[5] From a fit to $J^{PC} = 2^{-+}$ $f_2(1270)\pi$, $f_0(1370)\pi$ waves.

[6] From a fit to $J^P = 2^-$ $f_2(1270)\pi$ partial wave.

[7] Clear phase rotation seen in 2^-S, 2^-P, 2^-D waves. We quote central value and spread of single-resonance fits to three channels.

[8] From a two-resonance fit to four 2^-0^+ waves. This should not be averaged with all the single resonance fits.



$\pi_2(1670)$ width (MeV)

$\pi_2(1670)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	3π	(95.8 ± 1.4) %
Γ_2	$f_2(1270)\pi$	(56.2 ± 3.2) %
Γ_3	$\rho\pi$	$(31\ \pm4\ )$ %
Γ_4	$f_0(1370)\pi$	$(\ 8.7\pm3.4)$ %
Γ_5	$K\overline{K}^*(892)+$ c.c.	$(\ 4.2\pm1.4)$ %
Γ_6	$\gamma\gamma$	
Γ_7	$\eta\pi$	
Γ_8	$\pi^\pm 2\pi^+ 2\pi^-$	

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 6 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 =$ 1.9 for 3 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle\delta x_i \delta x_j\rangle/(\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_3	−53		
x_4	−29	−59	
x_5	−8	−21	−9
	x_2	x_3	x_4

$\pi_2(1670)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ — Γ_6

VALUE (keV)	*CL%*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
<0.072	90	[9] ACCIARRI	97T	L3		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
<0.19	90	[9] ALBRECHT	97B	ARG		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$

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

VALUE (keV)	*CL%*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
1.41 ±0.23±0.28		ANTREASYAN	90	CBAL	0	$e^+e^- \to e^+e^-\pi^0\pi^0\pi^0$
0.8 ±0.3 ±0.12		[10] BEHREND	90C	CELL	0	$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
1.3 ±0.3 ±0.2		[11] BEHREND	90C	CELL	0	$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$

[9] Decaying into $f_2(1270)\pi$ and $\rho\pi$.
[10] Constructive interference between $f_2(1270)\pi$,$\rho\pi$ and background.
[11] Incoherent Ansatz.

$\pi_2(1670)$ BRANCHING RATIOS

$\Gamma(3\pi)/\Gamma_{total}$ — $\Gamma_1/\Gamma = (\Gamma_2+\Gamma_3+\Gamma_4)/\Gamma$

VALUE	*DOCUMENT ID*
0.958±0.014 OUR FIT	

$\Gamma(\rho\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ — $\frac{1}{2}\Gamma_3/(0.567\Gamma_2+\frac{1}{2}\Gamma_3+0.624\Gamma_4)$

VALUE	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
0.29±0.04 OUR FIT					
0.29±0.05	[12] DAUM	81B	SPEC		63,94 $\pi^- p$

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

VALUE	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
<0.3	BARTSCH	68	HBC	+	8 $\pi^+ p \to 3\pi p$

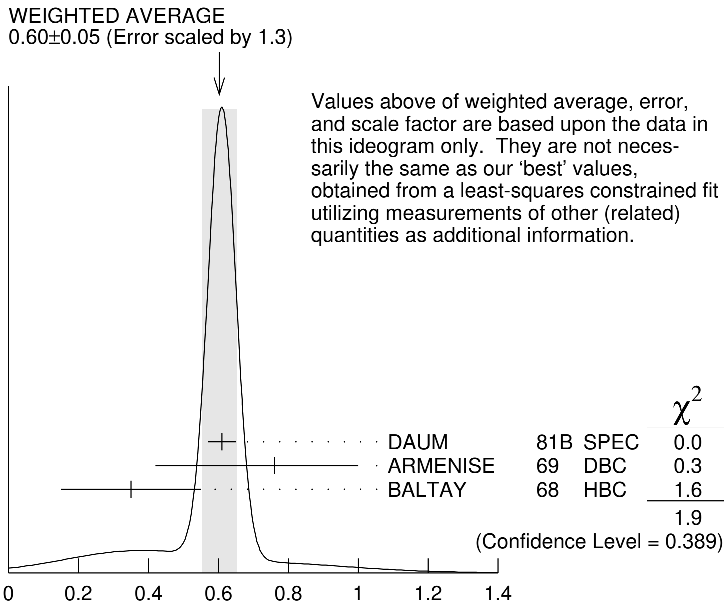
[12] From a two-resonance fit to four 2^-0^+ waves.

$\Gamma\big(f_2(1270)\pi\big)/\Gamma\big(\pi^{\pm}\pi^{+}\pi^{-}\big)$ $\quad$ $0.567\Gamma_2/(0.567\Gamma_2+\frac{1}{2}\Gamma_3+0.624\Gamma_4)$

(With $f_2(1270) \to \pi^{+}\pi^{-}$.)

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.604±0.035 OUR FIT					
0.60 ±0.05 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
0.61 ±0.04	[13] DAUM	81B	SPEC		63,94 $\pi^{-}p$
0.76 $^{+0.24}_{-0.34}$	ARMENISE	69	DBC	+	5.1 $\pi^{+}d \to d3\pi$
0.35 ±0.20	BALTAY	68	HBC	+	7–8.5 $\pi^{+}p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.59	BARTSCH	68	HBC	+	8 $\pi^{+}p \to 3\pi p$

[13] From a two-resonance fit to four $2^{-}0^{+}$ waves.



$\Gamma\big(f_2(1270)\pi\big)/\Gamma\big(\pi^{\pm}\pi^{+}\pi^{-}\big)$

$\Gamma\big(\eta\pi\big)/\Gamma\big(\pi^{\pm}\pi^{+}\pi^{-}\big)$ $\quad$ $\Gamma_7/(0.567\Gamma_2+\frac{1}{2}\Gamma_3+0.624\Gamma_4)$

(All η decays.)

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
<0.09	BALTAY	68	HBC	+	7–8.5 $\pi^{+}p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.10	CRENNELL	70	HBC	−	6 $\pi^{-}p \to f_2\pi^{-}N$

$\Gamma\big(\pi^{\pm}2\pi^{+}2\pi^{-}\big)/\Gamma\big(\pi^{\pm}\pi^{+}\pi^{-}\big)$ $\quad$ $\Gamma_8/(0.567\Gamma_2+\frac{1}{2}\Gamma_3+0.624\Gamma_4)$

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
<0.10	CRENNELL	70	HBC	−	6 $\pi^{-}p \to f_2\pi^{-}N$
<0.1	BALTAY	68	HBC	+	7,8.5 $\pi^{+}p$

$\Gamma(f_0(1370)\pi)/\Gamma(\pi^{\pm}\pi^{+}\pi^{-})$ $0.624\Gamma_4/(0.567\Gamma_2+\frac{1}{2}\Gamma_3+0.624\Gamma_4)$

(With $f_0(1370) \to \pi^+\pi^-$.)

VALUE	DOCUMENT ID		TECN	COMMENT
0.10±0.04 OUR FIT				
0.10±0.05	[14] DAUM	81B	SPEC	63,94 $\pi^- p$

[14] From a two-resonance fit to four 2^-0^+ waves.

$\Gamma(K\overline{K}^*(892)+\text{c.c.})/\Gamma(f_2(1270)\pi)$ Γ_5/Γ_2

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.075±0.025 OUR FIT					
0.075±0.025	[15] ARMSTRONG	82B	OMEG	−	16 $\pi^- p \to K^+ K^- \pi^- p$

[15] From a partial-wave analysis of $K^+ K^- \pi^-$ system.

D-wave/S-wave RATIO FOR $\pi_2(1670) \to f_2(1270)\pi$

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.22±0.10	[16] DAUM	81B	SPEC	63,94 $\pi^- p$

[16] From a two-resonance fit to four 2^-0^+ waves.

$\pi_2(1670)$ REFERENCES

ACCIARRI	97T	PL B413 147	M. Acciarri+	
ALBRECHT	97B	ZPHY C74 469	+Hamacher, Hofmann+	(ARGUS Collab.)
AMELIN	95B	PL B356 595	+Berdnikov, Bityukov+	(SERP, TBIL)
BERDNIKOV	94	PL B337 219	+Bityukov+	(SERP, TBIL)
ANTREASYAN	90	ZPHY C48 561	+Bartels, Besset+	(Crystal Ball Collab.)
BEHREND	90C	ZPHY C46 583	+Criegee+	(CELLO Collab.)
ANTIPOV	87	EPL 4 403	+Batarin+	(SERP, JINR, INRM, TBIL, BGNA, MILA)
ARMSTRONG	82B	NP B202 1	+Baccari	(AACH3, BARI, BONN, CERN, GLAS+)
DAUM	81B	NP B182 269	+Hertzberger+	(AMST, CERN, CRAC, MPIM, OXF+)
EVANGELISTA	81	NP B178 197	+	(BARI, BONN, CERN, DARE, LIVP+)
Also	81B	NP B186 594	Evangelista	
DAUM	80D	PL 89B 285	+Hertzberger+	(AMST, CERN, CRAC, MPIM, OXF+) JP
BALTAY	77	PRL 39 591	+Cautis, Kalelkar	(COLU) JP
ASCOLI	73	PR D7 669		(ILL, TNTO, GENO, HAMB, MILA, SACL) JP
CRENNELL	70	PRL 24 781	+Karshon, Lai, Scarr, Sims	(BNL)
ARMENISE	69	LNC 2 501	+Ghidini, Forino, Cartacci+	(BARI, BGNA, FIRZ)
BALTAY	68	PRL 20 887	+Kung, Yeh, Ferbel+	(COLU, ROCH, RUTG, YALE) I
BARTSCH	68	NP B7 345	+Keppel, Kraus+	(AACH, BERL, CERN) JP

OTHER RELATED PAPERS

CHEN	83B	PR D28 2304	+Fenker+	(ARIZ, FNAL, FLOR, NDAM, TUFTS+)
LEEDOM	83	PR D27 1426	+DeBonte, Gaidos, Key, Wong+	(PURD, TNTO)
BELLINI	82B	NP B199 1	+	(CERN, MILA, JINR, BGNA, HELS, PAVI, WARS+)
FOCACCI	66	PRL 17 890	+Kienzle, Levrat, Maglich, Martin	(CERN)
LEVRAT	66	PL 22 714	+Tolstrup+	(CERN Missing Mass Spect. Collab.)
VETLITSKY	66	PL 21 579	+Guszavin, Kliger, Zolganov+	(ITEP)
FORINO	65B	PL 19 68	+Gessaroli+	(BGNA, BARI, FIRZ, ORSAY, SACL)