$f_1(1420)$

$I^G(J^{PC}) = 0^+(1^{++})$

See the minireview under $\eta(1405)$.

$f_1(1420)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1426.4± 0.9 OUR AVERAGE		Error includes scale factor of 1.1.			
1434 ± 5 ± 5	133	[1] ACHARD	07	L3	183–209 $e^+e^- \rightarrow e^+e^- K^0_S K^\pm \pi^\mp$
1426 ± 6	711	ABDALLAH	03H	DLPH	91.2 $e^+e^- \rightarrow K^0_S K^\pm \pi^\mp + X$
1420 ±14	3651	NICHITIU	02	OBLX	
1428 ± 4 ± 2	20k	ADAMS	01B	B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
1426 ± 1		BARBERIS	97C	OMEG	450 $pp \rightarrow pp K^0_S K^\pm \pi^\mp$
1425 ± 8		BERTIN	97	OBLX	0.0 $\overline{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1435 ± 9		PROKOSHKIN	97B	GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1430 ± 4		[2] ARMSTRONG	92E	OMEG	85,300 $\pi^+ p$, $pp \rightarrow \pi^+ p$, $pp(K\overline{K}\pi)$
1462 ±20		[3] AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K \overline{K} \pi$
1443 $^{+7}_{-6}$ $^{+3}_{-2}$	1100	BAI	90C	MRK3	$J/\psi \rightarrow \gamma K^0_S K^\pm \pi^\mp$
1425 ±10	17	BEHREND	89	CELL	$\gamma\gamma \rightarrow K^0_S K^\pm \pi^\mp$
1442 ± 5 $^{+10}_{-17}$	111	BECKER	87	MRK3	e^+e^-, $\omega K \overline{K} \pi$
1423 ± 4		GIDAL	87B	MRK2	$e^+e^- \rightarrow e^+e^- K\overline{K}\pi$
1417 ±13	13	AIHARA	86C	TPC	$e^+e^- \rightarrow e^+e^- K\overline{K}\pi$
1422 ± 3		CHAUVAT	84	SPEC	ISR 31.5 pp
1440 ±10		[4] BROMBERG	80	SPEC	100 $\pi^- p \rightarrow K\overline{K}\pi X$
1426 ± 6	221	DIONISI	80	HBC	4 $\pi^- p \rightarrow K\overline{K}\pi n$
1420 ±20		DAHL	67	HBC	1.6–4.2 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1430.8± 0.9		[5] SOSA	99	SPEC	$pp \rightarrow p_{slow} (K^0_S K^+ \pi^-) p_{fast}$
1433.4± 0.8		[5] SOSA	99	SPEC	$pp \rightarrow p_{slow} (K^0_S K^- \pi^+) p_{fast}$
1429 ± 3	389	ARMSTRONG	89	OMEG	300 $pp \rightarrow K\overline{K}\pi pp$
1425 ± 2	1520	ARMSTRONG	84	OMEG	85 $\pi^+ p$, $pp \rightarrow (\pi^+, p)(K\overline{K}\pi)p$
~ 1420		BITYUKOV	84	SPEC	32 $K^- p \rightarrow K^+ K^- \pi^0 Y$

[1] From a fit with a width fixed at 55 MeV.
[2] This result supersedes ARMSTRONG 84, ARMSTRONG 89.
[3] From fit to the $K^*(892) K$ 1^{++} partial wave.
[4] Mass error increased to account for $a_0(980)$ mass cut uncertainties.
[5] No systematic error given.

$f_1(1420)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
54.9± 2.6 OUR AVERAGE					
51 ±14	711	ABDALLAH	03H	DLPH	91.2 $e^+e^- \to K^0_S K^\pm \pi^\mp + X$
61 ± 8	3651	NICHITIU	02	OBLX	
38 ± 9 ±6	20k	ADAMS	01B	B852	18 GeV $\pi^- p \to K^+ K^- \pi^0 n$
58 ± 4		BARBERIS	97C	OMEG	450 $pp \to pp K^0_S K^\pm \pi^\mp$
45 ±10		BERTIN	97	OBLX	0.0 $\overline{p}p \to K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
90 ±25		PROKOSHKIN	97B	GAM4	100 $\pi^- p \to \eta \pi^0 \pi^0 n$
58 ±10		[6] ARMSTRONG	92E	OMEG	85,300 $\pi^+ p$, $pp \to \pi^+ p$, $pp(K\overline{K}\pi)$
129 ±41		[7] AUGUSTIN	92	DM2	$J/\psi \to \gamma K \overline{K} \pi$
68 $^{+29}_{-18}$ $^{+8}_{-9}$	1100	BAI	90C	MRK3	$J/\psi \to \gamma K^0_S K^\pm \pi^\mp$
42 ±22	17	BEHREND	89	CELL	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$
40 $^{+17}_{-13}$ ±5	111	BECKER	87	MRK3	$e^+e^- \to \omega K \overline{K} \pi$
35 $^{+47}_{-20}$	13	AIHARA	86C	TPC	$e^+e^- \to e^+e^- K \overline{K} \pi$
47 ±10		CHAUVAT	84	SPEC	ISR 31.5 pp
62 ±14		BROMBERG	80	SPEC	100 $\pi^- p \to K \overline{K} \pi X$
40 ±15	221	DIONISI	80	HBC	4 $\pi^- p \to K \overline{K} \pi n$
60 ±20		DAHL	67	HBC	1.6–4.2 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
68.7± 2.9		[8] SOSA	99	SPEC	$pp \to p_{slow} (K^0_S K^+ \pi^-) p_{fast}$
58.8± 3.3		[8] SOSA	99	SPEC	$pp \to p_{slow} (K^0_S K^- \pi^+) p_{fast}$
58 ± 8	389	ARMSTRONG	89	OMEG	300 $pp \to K \overline{K} \pi pp$
62 ± 5	1520	ARMSTRONG	84	OMEG	85 $\pi^+ p$, $pp \to (\pi^+, p)(K\overline{K}\pi)p$
~ 50		BITYUKOV	84	SPEC	32 $K^- p \to K^+ K^- \pi^0 Y$

[6] This result supersedes ARMSTRONG 84, ARMSTRONG 89.
[7] From fit to the $K^*(892) K$ 1^{++} partial wave.
[8] No systematic error given.

$f_1(1420)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$K \overline{K} \pi$	dominant
Γ_2	$K \overline{K}^*(892) +$ c.c.	dominant
Γ_3	$\eta \pi \pi$	possibly seen
Γ_4	$a_0(980) \pi$	

Γ_5	$\pi\pi\rho$	
Γ_6	4π	
Γ_7	$\rho^0\gamma$	
Γ_8	$\phi\gamma$	seen

$f_1(1420)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\overline{K}\pi)$ × $\Gamma(\gamma\gamma^*)/\Gamma_{\text{total}}$

VALUE (keV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.9±0.4 OUR AVERAGE						
3.2±0.6±0.7		133	[9,10] ACHARD	07	L3	183–209 $e^+e^- \to e^+e^- K^0_S K^\pm \pi^\mp$
3.0±0.9±0.7			[11,12] BEHREND	89	CELL	$e^+e^- \to e^+e^- K^0_S K\pi$
$2.3^{+1.0}_{-0.9}\pm0.8$			HILL	89	JADE	$e^+e^- \to e^+e^- K^\pm K^0_S \pi^\mp$
1.3±0.5±0.3			AIHARA	88B	TPC	$e^+e^- \to e^+e^- K^\pm K^0_S \pi^\mp$
1.6±0.7±0.3			[11,13] GIDAL	87B	MRK2	$e^+e^- \to e^+e^- K\overline{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<8.0	95		JENNI	83	MRK2	$e^+e^- \to e^+e^- K\overline{K}\pi$

[9] From a fit with a width fixed at 55 MeV.
[10] The form factor parameter from the fit is 926 ± 78 MeV.
[11] Assume a ρ-pole form factor.
[12] A ϕ - pole form factor gives considerably smaller widths.
[13] Published value divided by 2.

$f_1(1420)$ BRANCHING RATIOS

$\Gamma(K\overline{K}^*(892)+\text{c.c.})/\Gamma(K\overline{K}\pi)$ — Γ_2/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.76±0.06	BROMBERG	80	SPEC	$100\ \pi^- p \to K\overline{K}\pi X$
0.86±0.12	DIONISI	80	HBC	$4\ \pi^- p \to K\overline{K}\pi n$

$\Gamma(\pi\pi\rho)/\Gamma(K\overline{K}\pi)$ — Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.3	95	CORDEN	78	OMEG	12–15 $\pi^- p$
<2.0		DAHL	67	HBC	1.6–4.2 $\pi^- p$

$\Gamma(\eta\pi\pi)/\Gamma(K\overline{K}\pi)$ — Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.1	95	ARMSTRONG	91B	OMEG	300 $pp \to pp\eta\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.35±0.75		KOPKE	89	MRK3	$J/\psi \to \omega\eta\pi\pi(K\overline{K}\pi)$
<0.6	90	GIDAL	87	MRK2	$e^+e^- \to e^+e^-\eta\pi^+\pi^-$
<0.5	95	CORDEN	78	OMEG	12–15 $\pi^- p$
1.5 ±0.8		DEFOIX	72	HBC	0.7 $\overline{p}p$

$\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$ — Γ_4/Γ_3

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
>0.1	90	PROKOSHKIN	97B	GAM4	100 $\pi^- p \to \eta\pi^0\pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen in either mode		ANDO	86	SPEC	8 $\pi^- p$
not seen in either mode		CORDEN	78	OMEG	12–15 $\pi^- p$
0.4±0.2		DEFOIX	72	HBC	0.7 $\overline{p}p \to 7\pi$

$\Gamma(4\pi)/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_6/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.90	95	DIONISI	80	HBC	4 $\pi^- p$

$\Gamma(K\overline{K}\pi)/[\Gamma(K\overline{K}^*(892)+\text{c.c.})+\Gamma(a_0(980)\pi)]$ — $\Gamma_1/(\Gamma_2+\Gamma_4)$

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.65±0.27	[14] DIONISI	80	HBC	4 $\pi^- p$

[14] Calculated using $\Gamma(K\overline{K})/\Gamma(\eta\pi) = 0.24 \pm 0.07$ for $a_0(980)$ fractions.

$\Gamma(a_0(980)\pi)/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_4/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
0.04±0.01±0.01		BARBERIS	98C	OMEG	450 $pp \to p_f f_1(1420) p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.04	68	ARMSTRONG	84	OMEG	85 $\pi^+ p$

$\Gamma(4\pi)/\Gamma(K\overline{K}\pi)$ — Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.62	95	ARMSTRONG	89G	OMEG	85 $\pi p \to 4\pi X$

$\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$ — Γ_7/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.08	95	[15] ARMSTRONG	92C	SPEC	300 $pp \to pp\pi^+\pi^-\gamma$

[15] Using the data on the $\overline{K}K\pi$ mode from ARMSTRONG 89.

$\Gamma(\rho^0\gamma)/\Gamma(K\overline{K}\pi)$ — Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.02	95	BARBERIS	98C	OMEG	450 $pp \to p_f f_1(1420) p_s$

$\Gamma(\phi\gamma)/\Gamma(K\overline{K}\pi)$ — Γ_8/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.003±0.001±0.001	BARBERIS	98C	OMEG	450 $pp \to p_f f_1(1420) p_s$

$f_1(1420)$ REFERENCES

ACHARD	07	JHEP 0703 018	P. Achard *et al.*	(L3 Collab.)	
ABDALLAH	03H	PL B569 129	J. Abdallah *et al.*	(DELPHI Collab.)	
NICHITIU	02	PL B545 261	F. Nichitiu *et al.*	(OBELIX Collab.)	
ADAMS	01B	PL B516 264	G.S. Adams *et al.*	(BNL E852 Collab.)	
SOSA	99	PRL 83 913	M. Sosa *et al.*		
BARBERIS	98C	PL B440 225	D. Barberis *et al.*	(WA 102 Collab.)	
BARBERIS	97C	PL B413 225	D. Barberis *et al.*	(WA 102 Collab.)	
BERTIN	97	PL B400 226	A. Bertin *et al.*	(OBELIX Collab.)	
PROKOSHKIN	97B	PD 42 298	Yu.D. Prokoshkin, S.A. Sadovsky		
		Translated from DANS 354 751.			
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)	
ARMSTRONG	92E	ZPHY C56 29	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)	JPC
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)	
BAI	90C	PRL 65 2507	Z. Bai *et al.*	(Mark III Collab.)	
ARMSTRONG	89	PL B221 216	T.A. Armstrong *et al.*	(CERN, CDEF, BIRM+)	JPC
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong *et al.*	(CERN, BIRM, BARI+)	
BEHREND	89	ZPHY C42 367	H.J. Behrend *et al.*	(CELLO Collab.)	
HILL	89	ZPHY C42 355	P. Hill *et al.*	(JADE Collab.)	JP
KOPKE	89	PRPL 174 67	L. Kopke *et al.*	(CERN)	
AIHARA	88B	PL B209 107	H. Aihara *et al.*	(TPC-2γ Collab.)	
BECKER	87	PRL 59 186	J.J. Becker *et al.*	(Mark III Collab.)	JP
GIDAL	87	PRL 59 2012	G. Gidal *et al.*	(LBL, SLAC, HARV)	
GIDAL	87B	PRL 59 2016	G. Gidal *et al.*	(LBL, SLAC, HARV)	
AIHARA	86C	PRL 57 2500	H. Aihara *et al.*	(TPC-2γ Collab.)	JP
ANDO	86	PRL 57 1296	A. Ando *et al.*	(KEK, KYOT, NIRS, SAGA+)	
ARMSTRONG	84	PL 146B 273	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)	JP
BITYUKOV	84	SJNP 39 735	S. Bityukov *et al.*	(SERP)	
		Translated from YAF 39 1165.			
CHAUVAT	84	PL 148B 382	P. Chauvat *et al.*	(CERN, CLER, UCLA+)	
JENNI	83	PR D27 1031	P. Jenni *et al.*	(SLAC, LBL)	
BROMBERG	80	PR D22 1513	C.M. Bromberg *et al.*	(CIT, FNAL, ILLC+)	
DIONISI	80	NP B169 1	C. Dionisi *et al.*	(CERN, MADR, CDEF+)	IJP
CORDEN	78	NP B144 253	M.J. Corden *et al.*	(BIRM, RHEL, TELA+)	
DEFOIX	72	NP B44 125	C. Defoix *et al.*	(CDEF, CERN)	
DAHL	67	PR 163 1377	O.I. Dahl *et al.*	(LRL)	IJP
Also		PRL 14 1074	D.H. Miller *et al.*	(LRL, UCB)	