$f_2(1270)$

$I^G(J^{PC}) = 0^+(2^{++})$

$f_2(1270)$ MASS

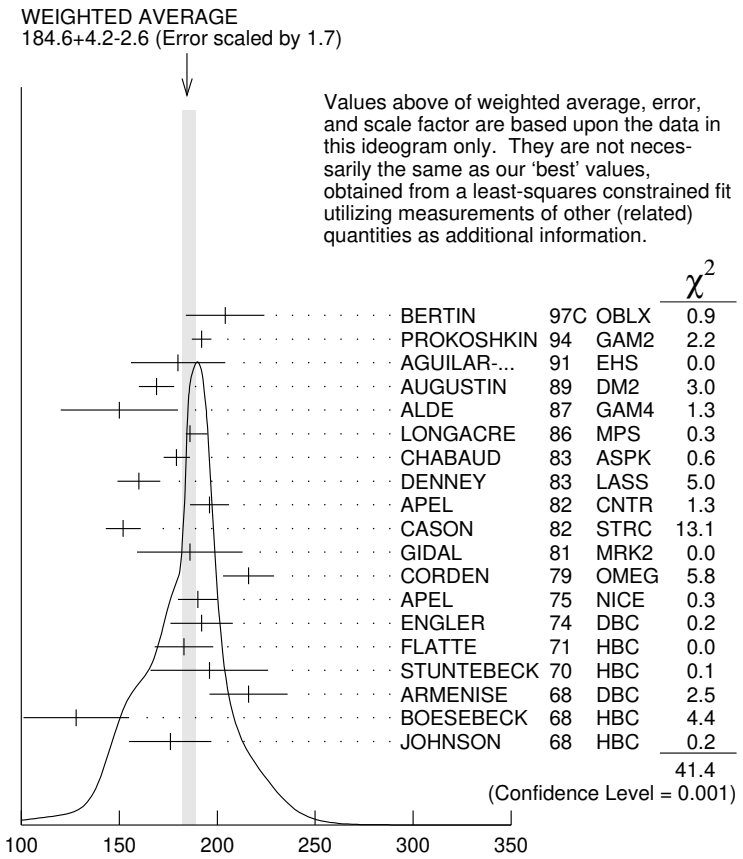
VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1275.0± 1.2 OUR AVERAGE					
1278 ± 5		[1] BERTIN	97C	OBLX	0.0 $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$
1272 ± 8	200k	PROKOSHKIN	94	GAM2	38 $\pi^- p \rightarrow \pi^0\pi^0 n$
1269.7± 5.2	5730	AUGUSTIN	89	DM2	$e^+e^- \rightarrow 5\pi$
1283 ± 8	400	[2] ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$
1274 ± 5		[2] AUGUSTIN	87	DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1283 ± 6		[3] LONGACRE	86	MPS	22 $\pi^- p \rightarrow n2K^0_S$
1276 ± 7		COURAU	84	DLCO	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
1273.3± 2.3		[4] CHABAUD	83	ASPK	17 $\pi^- p$ polarized
1280 ± 4		[5] CASON	82	STRC	8 $\pi^+ p \rightarrow \Delta^{++}\pi^0\pi^0$
1281 ± 7	11600	GIDAL	81	MRK2	J/ψ decay
1282 ± 5		[6] CORDEN	79	OMEG	12–15 $\pi^- p \rightarrow n2\pi$
1269 ± 4	10k	APEL	75	NICE	40 $\pi^- p \rightarrow n2\pi^0$
1272 ± 4	4600	ENGLER	74	DBC	6 $\pi^+ n \rightarrow \pi^+\pi^- p$
1277 ± 4	5300	FLATTE	71	HBC	7.0 $\pi^+ p$
1273 ± 8		[2] STUNTEBECK	70	HBC	8 $\pi^- p$, 5.4 $\pi^+ d$
1265 ± 8		BOESEBECK	68	HBC	8 $\pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1260 ±10		[7] ALDE	97	GAM2	450 $pp \rightarrow pp\pi^0\pi^0$
1278 ± 6		[7] GRYGOREV	96	SPEC	40 $\pi^- N \rightarrow K^0_S K^0_S X$
1262 ±11		AGUILAR-...	91	EHS	400 pp
1275 ±10		AKER	91	CBAR	0.0 $\overline{p}p \rightarrow 3\pi^0$
1220 ±10		BREAKSTONE	90	SFM	$pp \rightarrow pp\pi^+\pi^-$
1288 ±12		ABACHI	86B	HRS	$e^+e^- \rightarrow \pi^+\pi^- X$
1284 ±30	3k	BINON	83	GAM2	38 $\pi^- p \rightarrow n2\eta$
1280 ±20	3k	APEL	82	CNTR	25 $\pi^- p \rightarrow n2\pi^0$
1284 ±10	16000	DEUTSCH...	76	HBC	16 $\pi^+ p$
1258 ±10	600	TAKAHASHI	72	HBC	8 $\pi^- p \rightarrow n2\pi$
1275 ±13		ARMENISE	70	HBC	9 $\pi^+ n \rightarrow p\pi^+\pi^-$
1261 ± 5	1960	[2] ARMENISE	68	DBC	5.1 $\pi^+ n \rightarrow p\pi^+$ MM$^-$
1270 ±10	360	[2] ARMENISE	68	DBC	5.1 $\pi^+ n \rightarrow p\pi^0$ MM
1268 ± 6		[8] JOHNSON	68	HBC	3.7–4.2 $\pi^- p$

[1] T-matrix pole.
[2] Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
[3] From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
[4] From an energy-independent partial-wave analysis.
[5] From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.
[6] From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.
[7] Systematic uncertainties not estimated.
[8] JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

$f_2(1270)$ WIDTH

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$185.5^{+3.8}_{-2.7}$ OUR FIT	Error includes scale factor of 1.5.				
$184.6^{+4.2}_{-2.6}$ OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.				
204 ±20		[9] BERTIN	97C	OBLX	0.0 $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$
192 ± 5	200k	PROKOSHKIN	94	GAM2	38 $\pi^- p \rightarrow \pi^0\pi^0 n$
180 ±24		AGUILAR-...	91	EHS	400 pp
169 ± 9	5730	[10] AUGUSTIN	89	DM2	$e^+e^- \rightarrow 5\pi$
150 ±30	400	[10] ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$
186^{+9}_{-2}		[11] LONGACRE	86	MPS	22 $\pi^- p \rightarrow n2K^0_S$
$179.2^{+6.9}_{-6.6}$		[12] CHABAUD	83	ASPK	17 $\pi^- p$ polarized
160 ±11		DENNEY	83	LASS	10 $\pi^+ N$
196 ±10	3k	APEL	82	CNTR	25 $\pi^- p \rightarrow n2\pi^0$
152 ± 9		[13] CASON	82	STRC	8 $\pi^+ p \rightarrow \Delta^{++}\pi^0\pi^0$
186 ±27	11600	GIDAL	81	MRK2	J/ψ decay
216 ±13		[14] CORDEN	79	OMEG	12–15 $\pi^- p \rightarrow n2\pi$
190 ±10	10k	APEL	75	NICE	40 $\pi^- p \rightarrow n2\pi^0$
192 ±16	4600	ENGLER	74	DBC	6 $\pi^+ n \rightarrow \pi^+\pi^- p$
183 ±15	5300	FLATTE	71	HBC	7 $\pi^+ p \rightarrow \Delta^{++} f_2$
196 ±30		[10] STUNTEBECK	70	HBC	8 $\pi^- p$, 5.4 $\pi^+ d$
216 ±20	1960	[10] ARMENISE	68	DBC	5.1 $\pi^+ n \rightarrow p\pi^+$ MM$^-$
128 ±27		[10] BOESEBECK	68	HBC	8 $\pi^+ p$
176 ±21		[10,15] JOHNSON	68	HBC	3.7–4.2 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
187 ±20		[16] ALDE	97	GAM2	450 $pp \rightarrow pp\pi^0\pi^0$
184 ±10		[16] GRYGOREV	96	SPEC	40 $\pi^- N \rightarrow K^0_S K^0_S X$
200 ±10		AKER	91	CBAR	0.0 $\overline{p}p \rightarrow 3\pi^0$
240 ±40	3k	BINON	83	GAM2	38 $\pi^- p \rightarrow n2\eta$
187 ±30	650	[10] ANTIPOV	77	CIBS	25 $\pi^- p \rightarrow p3\pi$
225 ±38	16000	DEUTSCH...	76	HBC	16 $\pi^+ p$
166 ±28	600	[10] TAKAHASHI	72	HBC	8 $\pi^- p \rightarrow n2\pi$
173 ±53		[10] ARMENISE	70	HBC	9 $\pi^+ n \rightarrow p\pi^+\pi^-$

[9] T-matrix pole.
[10] Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
[11] From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
[12] From an energy-independent partial-wave analysis.
[13] From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.
[14] From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.
[15] JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.
[16] Systematic uncertainties not estimated.



$f_2(1270)$ width (MeV)

$f_2(1270)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$\pi\pi$	$(84.6\ ^{+2.5}_{-1.3})$ %	S=1.3
Γ_2	$\pi^+\pi^-2\pi^0$	$(\ 7.2\ ^{+1.5}_{-2.7})$ %	S=1.3
Γ_3	$K\overline{K}$	$(\ 4.6\ \pm0.4\ )$ %	S=2.8
Γ_4	$2\pi^+2\pi^-$	$(\ 2.8\ \pm0.4\ )$ %	S=1.2
Γ_5	$\eta\eta$	$(\ 4.5\ \pm1.0\ )\times10^{-3}$	S=2.4

Γ_6	$4\pi^0$		$(\ 3.0\ \pm 1.0\ ) \times 10^{-3}$		
Γ_7	$\gamma\gamma$		$(\ 1.32^{+0.17}_{-0.16}) \times 10^{-5}$		
Γ_8	$\eta\pi\pi$	$<$	8	$\times 10^{-3}$	CL=95%
Γ_9	$K^0 K^- \pi^+ +$ c.c.	$<$	3.4	$\times 10^{-3}$	CL=95%
Γ_{10}	$e^+ e^-$	$<$	9	$\times 10^{-9}$	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 4 partial widths, a combination of partial widths obtained from integrated cross sections, and 6 branching ratios uses 39 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 70.7$ for 32 degrees of freedom.

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

x_2	−92						
x_3	11	−38					
x_4	11	−36	1				
x_5	2	−9	0	0			
x_6	0	−7	0	0	0		
x_7	8	−3	−15	1	0	0	
Γ	−79	74	−12	−9	−3	0	−10
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

	Mode	Rate (MeV)		Scale factor
Γ_1	$\pi\pi$	156.9	$^{+4.2}_{-1.2}$	
Γ_2	$\pi^+\pi^- 2\pi^0$	13.4	$^{+3.1}_{-5.1}$	1.3
Γ_3	$K\overline{K}$	8.6	± 0.8	2.9
Γ_4	$2\pi^+ 2\pi^-$	5.2	± 0.7	1.2
Γ_5	$\eta\eta$	0.83	± 0.18	2.4
Γ_6	$4\pi^0$	0.55	± 0.19	
Γ_7	$\gamma\gamma$	0.00244	$^{+0.00032}_{-0.00029}$	

$f_2(1270)$ PARTIAL WIDTHS

$\Gamma(\pi\pi)$ Γ_1

VALUE (MeV)		*DOCUMENT ID*		*TECN*	*COMMENT*
$156.9^{+4.2}_{-1.2}$ OUR FIT					
$157.0^{+6.0}_{-1.0}$		[17] LONGACRE	86	MPS	22 $\pi^- p \rightarrow n 2K^0_S$

$\Gamma(K\overline{K})$ Γ_3

VALUE (MeV)		*DOCUMENT ID*		*TECN*	*COMMENT*
8.6 ±0.8 OUR FIT	Error includes scale factor of 2.9.				
$9.0^{+0.7}_{-0.3}$		[17] LONGACRE	86	MPS	22 $\pi^- p \rightarrow n 2K^0_S$

$\Gamma(\eta\eta)$ Γ_5

VALUE (MeV)		*DOCUMENT ID*		*TECN*	*COMMENT*
0.83±0.18 OUR FIT	Error includes scale factor of 2.4.				
1.0 ±0.1		[17] LONGACRE	86	MPS	22 $\pi^- p \rightarrow n 2K^0_S$

$\Gamma(\gamma\gamma)$ Γ_7

The value of this width depends on the theoretical model used. Unitarised models with scalars give values clustering around $\simeq 2.6$; without an S-wave contribution, values are systematically higher (typically around 3). Since it is used to average results obtained with variety of models, we prefer to quote our own estimate.

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2.8 ±0.4 OUR ESTIMATE					
$2.44^{+0.32}_{-0.29}$ OUR FIT					
$2.58\pm0.13^{+0.36}_{-0.27}$		[18] BEHREND	92	CELL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$3.10\pm0.35\pm0.35$		[19] BLINOV	92	MD1	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$2.27\pm0.47\pm0.11$		ADACHI	90D	TOPZ	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$3.15\pm0.04\pm0.39$		BOYER	90	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$3.19\pm0.16^{+0.29}_{-0.28}$		MARSISKE	90	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
2.35 ± 0.65		[20] MORGAN	90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-,\ \pi^0\pi^0$
$3.19\pm0.09^{+0.22}_{-0.38}$	2177	OEST	90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
$3.2\ \pm0.1\ \pm0.4$		[21] AIHARA	86B	TPC	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
$2.5\ \pm0.1\ \pm0.5$		BEHREND	84B	CELL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$

$2.85 \pm 0.25 \pm 0.5$	[22] BERGER	84	PLUT	$e^+e^- \to e^+e^- 2\pi$	
$2.70 \pm 0.05 \pm 0.20$	COURAU	84	DLCO	$e^+e^- \to e^+e^-\pi^+\pi^-$	
$2.52 \pm 0.13 \pm 0.38$	[23] SMITH	84C	MRK2	$e^+e^- \to e^+e^-\pi^+\pi^-$	
$2.7 \pm 0.2 \pm 0.6$	EDWARDS	82F	CBAL	$e^+e^- \to e^+e^- 2\pi^0$	
$2.9 \ ^{+0.6}_{-0.4} \pm 0.6$	[24] EDWARDS	82F	CBAL	$e^+e^- \to e^+e^- 2\pi^0$	
$3.2 \pm 0.2 \pm 0.6$	BRANDELIK	81B	TASS	$e^+e^- \to e^+e^-\pi^+\pi^-$	
$3.6 \pm 0.3 \pm 0.5$	ROUSSARIE	81	MRK2	$e^+e^- \to e^+e^-\pi^+\pi^-$	
2.3 ± 0.8	[25] BERGER	80B	PLUT	e^+e^-	

$\Gamma(e^+e^-)$ Γ_{10}

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
<1.7	90	VOROBYEV	88	ND	$e^+e^- \to \pi^0\pi^0$

[17] From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
[18] Using a unitarized model with scalars.
[19] Using the unitarized model of LYTH 85.
[20] Error includes spread of different solutions. Data of MARK2 and CRYSTAL BALL used in the analysis. Authors report strong correlations with $\gamma\gamma$ width of $f_0(1370)$: $\Gamma(f_2) + 1/4\ \Gamma(f^0) = 3.6 \pm 0.3$ KeV.
[21] Radiative corrections modify the partial widths; for instance the COURAU 84 value becomes 2.66 ± 0.21 in the calculation of LANDRO 86.
[22] Using the MENNESSIER 83 model.
[23] Superseded by BOYER 90.
[24] If helicity = 2 assumption is not made.
[25] Using mass, width and $B(f_2(1270) \to 2\pi)$ from PDG 78.

$f_2(1270)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(total)$

$\Gamma(K\overline{K}) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_3\Gamma_7/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
$0.113 \ ^{+0.016}_{-0.015}$ OUR FIT	Error includes scale factor of 1.1.			
$0.091 \pm 0.007 \pm 0.027$	[26] ALBRECHT	90G	ARG	$e^+e^- \to e^+e^- K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.104 \pm 0.007 \pm 0.072$	[27] ALBRECHT	90G	ARG	$e^+e^- \to e^+e^- K^+K^-$

[26] Using an incoherent background.
[27] Using a coherent background.

$f_2(1270)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{total}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.846 \ ^{+0.025}_{-0.013}$ OUR FIT	Error includes scale factor of 1.3.				
0.837 ± 0.020 OUR AVERAGE					
0.849 ± 0.025		CHABAUD	83	ASPK	17 π^- p polarized
0.85 ± 0.05	250	BEAUPRE	71	HBC	8 $\pi^+ p \to \Delta^{++} f_2$
0.8 ± 0.04	600	OH	70	HBC	1.26 $\pi^- p \to \pi^+\pi^- n$

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi\pi)$ Γ_2/Γ_1

Should be twice $\Gamma(2\pi^+2\pi^-)/\Gamma(\pi\pi)$ if decay is $\rho\rho$. (See ASCOLI 68D.)

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.085^{+0.020}_{-0.034}$ OUR FIT		Error includes scale factor of 1.3.			
0.15 ±0.06	600	EISENBERG	74	HBC	4.9 $\pi^+ p \rightarrow \Delta^{++} f_2$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.07		EMMS	75D	DBC	4 $\pi^+ n \rightarrow p f_2$

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

We average only experiments which either take into account $f_2(1270)$-$a_2(1320)$ interference explicitly or demonstrate that $a_2(1320)$ production is negligible.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.055^{+0.005}_{-0.006}$ OUR FIT		Error includes scale factor of 2.8.			
$0.040^{+0.005}_{-0.006}$ OUR AVERAGE					
$0.037^{+0.008}_{-0.021}$		ETKIN	82B	MPS	23 $\pi^- p \rightarrow n 2K^0_S$
0.045 ±0.009		CHABAUD	81	ASPK	17 $\pi^- p$ polarized
0.039 ±0.008		LOVERRE	80	HBC	4 $\pi^- p \rightarrow K\overline{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.036 ±0.005		[28] COSTA...	80	OMEG	1–2.2 $\pi^- p \rightarrow K^+K^-n$
0.030 ±0.005		[29] MARTIN	79	RVUE	
0.027 ±0.009		[30] POLYCHRO...	79	STRC	7 $\pi^- p \rightarrow n 2K^0_S$
0.025 ±0.015		EMMS	75D	DBC	4 $\pi^+ n \rightarrow p f_2$
0.031 ±0.012	20	ADERHOLZ	69	HBC	8 $\pi^+ p \rightarrow K^+K^-\pi^+ p$

[28] Re-evaluated by CHABAUD 83.
[29] Includes PAWLICKI 77 data.
[30] Takes into account the $f_2(1270)$-$f'_2(1525)$ interference.

$\Gamma(2\pi^+2\pi^-)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.033±0.005 OUR FIT		Error includes scale factor of 1.2.			
0.033±0.004 OUR AVERAGE		Error includes scale factor of 1.1.			
0.024±0.006	160	EMMS	75D	DBC	4 $\pi^+ n \rightarrow p f_2$
0.051±0.025	70	EISENBERG	74	HBC	4.9 $\pi^+ p \rightarrow \Delta^{++} f_2$
$0.043^{+0.007}_{-0.011}$	285	LOUIE	74	HBC	3.9 $\pi^- p \rightarrow n f_2$
0.037±0.007	154	ANDERSON	73	DBC	6 $\pi^+ n \rightarrow p f_2$
0.047±0.013		OH	70	HBC	1.26 $\pi^- p \rightarrow \pi^+\pi^- n$

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
4.5±1.0 OUR FIT	Error includes scale factor of 2.4.			
3.1±0.8 OUR AVERAGE	Error includes scale factor of 1.3.			
2.8±0.7	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta n$
5.2±1.7	BINON	83	GAM2	38 $\pi^- p \rightarrow 2\eta n$

$\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.05	95	EDWARDS	82F	CBAL	$e^+e^- \to e^+e^- 2\eta$
<0.016	95	EMMS	75D	DBC	$4\ \pi^+ n \to p f_2$
<0.09	95	EISENBERG	74	HBC	$4.9\ \pi^+ p \to \Delta^{++} f_2$

$\Gamma(4\pi^0)/\Gamma_{total}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0030±0.0010 OUR FIT					
0.003 ±0.001	400± 50	ALDE	87	GAM4	$100\ \pi^- p \to 4\pi^0 n$

$\Gamma(\eta\pi\pi)/\Gamma(\pi\pi)$ Γ_8/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.010	95	EMMS	75D	DBC	$4\ \pi^+ n \to p f_2$

$\Gamma(K^0K^-\pi^+ + \text{c.c.})/\Gamma(\pi\pi)$ Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.004	95	EMMS	75D	DBC	$4\ \pi^+ n \to p f_2$

$f_2(1270)$ REFERENCES

ALDE	97	PL B397 350	+Bellazzini, Binon+	(GAMS Collab.)
BERTIN	97C	PL B408 476	A. Bertin, Bruschi+	(OBELIX Collab.)
GRYGOREV	96	PAN 59 2105	+Baloshin, Barkov	(ITEP)
		Translated from YAF 59 2187.		
PROKOSHKIN	94	SPD 39 420	+Kondashov	(SERP)
		Translated from DANS 336 613.		
BEHREND	92	ZPHY C56 381		(CELLO Collab.)
BLINOV	92	ZPHY C53 33	+Bondar, Bukin+	(NOVO)
AGUILAR-...	91	ZPHY C50 405	Aguilar-Benitez, Allison, Batalor+	(LEBC-EHS Collab.)
AKER	91	PL B260 249	+Amsler, Peters+	(Crystal Barrel Collab.)
ADACHI	90D	PL B234 185	+Doser+	(TOPAZ Collab.)
ALBRECHT	90G	ZPHY C48 183	+Ehrlichmann, Harder+	(ARGUS Collab.)
BOYER	90	PR D42 1350	+Butler+	(Mark II Collab.)
BREAKSTONE	90	ZPHY C48 569	+	(ISU, BGNA, CERN, DORT, HEIDH, WARS)
MARSISKE	90	PR D41 3324	+Antreasyan+	(Crystal Ball Collab.)
MORGAN	90	ZPHY C48 623	+Pennington	(RAL, DURH)
OEST	90	ZPHY C47 343	+Olsson+	(JADE Collab.)
AUGUSTIN	89	NP B320 1	+Cosme	(DM2 Collab.)
VOROBYEV	88	SJNP 48 273	+Golubev, Dolinsky, Druzhinin+	(NOVO)
		Translated from YAF 48 436.		
ALDE	87	PL B198 286	+Binon, Bricman+	(LANL, BRUX, SERP, LAPP)
AUGUSTIN	87	ZPHY C36 369	+Cosme+	(LALO, CLER, FRAS, PADO)
ABACHI	86B	PRL 57 1990	+Derrick, Blockus+	(PURD, ANL, IND, MICH, LBL)
AIHARA	86B	PRL 57 404	+Alston-Garnjost+	(TPC-2γ Collab.)
ALDE	86D	NP B269 485	+Binon, Bricman+	(BELG, LAPP, SERP, CERN, LANL)
LANDRO	86	PL B172 445	+Mork, Olsen	(UTRO)
LONGACRE	86	PL B177 223	+Etkin+	(BNL, BRAN, CUNY, DUKE, NDAM)
LYTH	85	JPG 11 459		
BEHREND	84B	ZPHY C23 223	+Fenner, Schachter, Schroeder+	(CELLO Collab.)
BERGER	84	ZPHY C26 199	+Klovning, Burger+	(PLUTO Collab.)
COURAU	84	PL 147B 227	+Johnson, Sherman, Atwood, Baillon+	(CIT, SLAC)
SMITH	84C	PR D30 851	+Burke, Abrams, Blocker, Levi+	(SLAC, LBL, HARV)
BINON	83	NC 78A 313	+Donskov, Duteil+	(BELG, LAPP, SERP, CERN)
Also	83B	SJNP 38 561	Binon, Gouanere+	(BELG, LAPP, SERP, CERN)
		Translated from YAF 38 934.		

CHABAUD	83	NP B223 1	+Gorlich, Cerrada+ (CERN, CRAC, MPIM)
DENNEY	83	PR D28 2726	+Cranley, Firestone, Chapman+ (IOWA, MICH)
MENNESSIER	83	ZPHY C16 241	(MONP)
APEL	82	NP B201 197	+Augenstein+(KARLK, KARLE, PISA, SERP, WIEN, CERN)
CASON	82	PRL 48 1316	+Biswas, Baumbaugh, Bishop+ (NDAM, ANL)
EDWARDS	82F	PL 110B 82	+Partridge, Peck+ (CIT, HARV, PRIN, STAN, SLAC)
ETKIN	82B	PR D25 1786	+Foley, Lai+ (BNL, CUNY, TUFTS, VAND)
BRANDELIK	81B	ZPHY C10 117	+Boerner+ (TASSO Collab.)
CHABAUD	81	APP B12 575	+Niczyporuk, Becker+ (CERN, CRAC, MPIM)
GIDAL	81	PL 107B 153	+Goldhaber, Guy, Millikan, Abrams+ (SLAC, LBL)
ROUSSARIE	81	PL 105B 304	+Burke, Abrams, Alam+ (SLAC, LBL)
BERGER	80B	PL 94B 254	+Genzer+ (PLUTO Collab.)
COSTA...	80	NP B175 402	Costa De Beauregard+ (BARI, BONN, CERN+)
LOVERRE	80	ZPHY C6 187	+Armenteros, Dionisi+ (CERN, CDEF, MADR, STOH)
CORDEN	79	NP B157 250	+Dowell, Garvey+ (BIRM, RHEL, TELA, LOWC)
MARTIN	79	NP B158 520	+Ozmutlu (DURH)
POLYCHRO...	79	PR D19 1317	Polychronakos, Cason, Bishop+ (NDAM, ANL)
PDG	78	PL 75B	Bricman+
ANTIPOV	77	NP B119 45	+Busnello, Damgaard, Kienzle+ (SERP, GEVA)
PAWLICKI	77	PR D15 3196	+Ayres, Cohen, Diebold, Kramer, Wicklund (ANL)
DEUTSCH...	76	NP B103 426	Deutschmann+ (AACH3, BERL, BONN, CERN+)
APEL	75	PL 57B 398	+Augenstein+(KARLK, KARLE, PISA, SERP, WIEN, CERN)
EMMS	75D	NP B96 155	+Kinson, Stacey, Votruba+ (BIRM, DURH, RHEL)
EISENBERG	74	PL 52B 239	+Engler, Haber, Karshon+ (REHO)
ENGLER	74	PR D10 2070	+Kraemer, Toaff, Weisser, Diaz+ (CMU, CASE)
LOUIE	74	PL 48B 385	+Alitti, Gandois, Chaloupka+ (SACL, CERN)
ANDERSON	73	PRL 31 562	+Engler, Kraemer, Toaff, Diaz+ (CMU, CASE)
TAKAHASHI	72	PR D6 1266	+Barish+ (TOHOK, PENN, NDAM, ANL)
BEAUPRE	71	NP B28 77	+Deutschmann, Graessler+ (AACH, BERL, CERN)
FLATTE	71	PL 34B 551	+Alston-Garnjost, Barbaro-Galtieri+ (LBL)
ARMENISE	70	LNC 4 199	+Ghidini, Foring, Cartacci+ (BARI, BGNA, FIRZ)
OH	70	PR D1 2494	+Garfinkel, Morse, Walker, Prentice (WISC, TNTO) JP
STUNTEBECK	70	PL 32B 391	+Kenney, Deery, Biswas, Cason+ (NDAM)
ADERHOLZ	69	NP B11 259	+Bartsch+ (AACH3, BERL, CERN, JAGL, WARS)
ARMENISE	68	NC 54A 999	+Ghidini, Forino+ (BARI, BGNA, FIRZ, ORSAY)
ASCOLI	68D	PRL 21 1712	+Crawley, Mortara+ (ILL)
BOESEBECK	68	NP B4 501	+Deutschmann+ (AACH, BERL, CERN)
JOHNSON	68	PR 176 1651	+Poirier, Biswas, Gutay+ (NDAM, PURD, SLAC)
EISNER	67	PR 164 1699	+Johnson, Klein, Peters, Sahni, Yen+ (PURD)
DERADO	65	PRL 14 872	+Kenney, Poirier, Shephard (NDAM)
LEE	64	PRL 12 342	+Roe, Sinclair, VanderVelde (MICH)
BONDAR	63	PL 5 153	+ (AACH, BIRM, BONN, DESY, LOIC, MPIM)