$f_0(1500)$

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

See the review on "Spectroscopy of Light Meson Resonances."

$f_0(1500)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2\ \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
(1430–1530) − *i* (40–90) OUR ESTIMATE				
$(1450 \pm 10) - i\,(53 \pm 8)$	[1] RODAS	22	RVUE	$J/\psi(1S) \to \gamma\,(\pi\pi,\ K\overline{K})$
$(1483 \pm 15) - i\,(58 \pm 6)$	SARANTSEV	21	RVUE	$J/\psi(1S) \to \gamma\,(\pi\pi,\ K\overline{K},\ \eta\eta,\ \omega\phi)$
$(1496 \pm 1.2^{+\ 4.4}_{-26.4}) - i\,(40.4 \pm 0.3^{+10.0}_{-\ 2.5})$	[2] ALBRECHT	20	RVUE	$0.9\ \overline{p}p \to \pi^0\pi^0\eta,\ \pi^0\eta\eta,\ \pi^0K^+K^-$
$(1465 \pm 18) - i\,(50 \pm 9)$	[3] ROPERTZ	18	RVUE	$\overline{B}{}^0_s \to J/\psi(\pi^+\pi^-/K^+K^-)$
$(1486 \pm 10) - i\,(57 \pm 5)$	ANISOVICH	09	RVUE	$0.0\ \overline{p}p,\ \pi N$
$(1489^{+8}_{-4}) - i\,(51 \pm 5)$	[4] ANISOVICH	03	RVUE	
$(1515 \pm 12) - i\,(55 \pm 12)$	BARBERIS	00A		$450\ pp \to p_f(\eta\eta',\ \eta'\eta')p_s$
$(1511 \pm 9) - i\,(51 \pm 9)$	[5] BARBERIS	00C		$450\ pp \to p_f 4\pi p_s$
$(1510 \pm 8) - i\,(55 \pm 8)$	BARBERIS	00E		$450\ pp \to p_f \eta\eta p_s$
$(1502 \pm 12 \pm 10) - i\,(49 \pm 9 \pm 8)$	[6] BARBERIS	99D	OMEG	$450\ pp \to K^+K^-,\ \pi^+\pi^-$
$(1447 \pm 27) - i\,(54 \pm 23)$	[7] KAMINSKI	99	RVUE	$\pi\pi \to \pi\pi,\ K\overline{K},\ \sigma\sigma$
$(1499 \pm 8) - i\,(65 \pm 10)$	ANISOVICH	98B	RVUE	Compilation.
$(1510 \pm 20) - i\,(60 \pm 18)$	BARBERIS	97B	OMEG	$450\ pp \to pp2(\pi^+\pi^-)$
$(1449 \pm 20) - i\,(57 \pm 15)$	BERTIN	97C	OBLX	$0.0\ \overline{p}p \to \pi^+\pi^-\pi^0$
$(1515 \pm 20) - i\,(53 \pm 8)$	ABELE	96B	CBAR	$0.0\ \overline{p}p \to \pi^0 K^0_L K^0_L$
$(1500 \pm 8) - i\,(66 \pm 8)$	ABELE	96C	RVUE	Compilation.
$(1500 \pm 10) - i\,(77 \pm 15)$	[8] AMSLER	95D	CBAR	$0.0\ \overline{p}p \to \pi^0\pi^0\pi^0,\ \pi^0\eta\eta,\ \pi^0\pi^0\eta$
$(1520 \pm 25) - i\,(74^{+10}_{-13})$	[9] ANISOVICH	94	CBAR	$0.0\ \overline{p}p \to 3\pi^0,\pi^0\eta\eta$
$(1505 \pm 20) - i\,(75 \pm 10)$	[10] BUGG	94	RVUE	$\overline{p}p \to 3\pi^0,\ \eta\eta\pi^0,\ \eta\pi^0\pi^0$

[1] T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \to \gamma\pi^0\pi^0$ (ABLIKIM 15AE) and $J/\psi \to \gamma K^0_S K^0_S$ (ABLIKIM 18AA).

[2] T-matrix pole, 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\overline{K}$), BINON 83 ($\eta\eta$), and BINON 84C ($\eta\eta'$).

[3] T-matrix pole of 3 channel unitary model fit to data from AAIJ 14BR and AAIJ 17V extracted using Pade approximants.

[4] Pole position from combined analysis of $\pi^- p \to \pi^0\pi^0 n$, $\pi^- p \to K\overline{K}n$, $\pi^+\pi^- \to \pi^+\pi^-$, $\overline{p}p \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$, $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, $K^0_S K^0_S\pi^0$, $K^+K^0_S\pi^-$ at rest, $\overline{p}n \to \pi^-\pi^-\pi^+$, $K^0_S K^-\pi^0$, $K^0_S K^0_S\pi^-$ at rest.

[5] Average between $\pi^+\pi^-2\pi^0$ and $2(\pi^+\pi^-)$.

[6] Supersedes BARBERIS 99 and BARBERIS 99B.

[7] T-matrix pole on sheet $--+$.
[8] Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
[9] From a simultaneous analysis of the annihilations $\overline{p}p \to 3\pi^0, \pi^0\eta\eta$.
[10] Reanalysis of ANISOVICH 94 data.

$f_0(1500)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1522 ±25		[1] BERTIN	98	OBLX	0.05–0.405 $\overline{n}p \to \pi^+\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1492.5 \pm 3.6^{+2.4}_{-20.5}$		[2] ABLIKIM	22G	BES3	$J/\psi \to \gamma\pi^+\pi^-\eta'$
$1447 \pm 16 \pm 13$	163	[3,4] DOBBS	15		$J/\psi \to \gamma\pi^+\pi^-$
$1442 \pm 9 \pm 4$	261	[3,4] DOBBS	15		$\psi(2S) \to \gamma\pi^+\pi^-$
1460.9 ± 2.9		[5] AAIJ	14BR	LHCB	$\overline{B}{}^0_s \to J/\psi\pi^+\pi^-$
$1468 ^{+14}_{-15} {}^{+23}_{-74}$	5.5k	[6] ABLIKIM	13N	BES3	$e^+e^- \to J/\psi \to \gamma\eta\eta$
1470 ± 60	568	[7] KLEMPT	08	E791	$D_s^+ \to \pi^-\pi^+\pi^+$
$1470 ^{+6}_{-7} {}^{+72}_{-255}$		[8] UEHARA	08A	BELL	10.6 $e^+e^- \to e^+e^-\pi^0\pi^0$
$1466 \pm 6 \pm 20$		[9] ABLIKIM	06V	BES2	$e^+e^- \to J/\psi \to \gamma\pi^+\pi^-$
1495 ± 4		AMSLER	06	CBAR	0.9 $\overline{p}p \to K^+K^-\pi^0$
1539 ± 20	9.9k	AUBERT	06O	BABR	$B^+ \to K^+K^+K^-$
1473 ± 5	80k	[9,10] UMAN	06	E835	5.2 $\overline{p}p \to \eta\eta\pi^0$
1478 ± 6		VLADIMIRSK...	06	SPEC	40 $\pi^-p \to K^0_S K^0_S n$
1493 ± 7		[9] BINON	05	GAMS	33 $\pi^-p \to \eta\eta n$
1524 ± 14	1400	[11] GARMASH	05	BELL	$B^+ \to K^+K^+K^-$
1490 ± 30		[9] ABELE	01	CBAR	0.0 $\overline{p}d \to \pi^-4\pi^0p$
1497 ± 10		[9] BARBERIS	99	OMEG	450 $pp \to p_s p_f K^+K^-$
1502 ± 10		[9] BARBERIS	99B	OMEG	450 $pp \to p_s p_f \pi^+\pi^-$
1530 ± 45		[9] BELLAZZINI	99	GAM4	450 $pp \to pp\pi^0\pi^0$
1505 ± 18		[9] FRENCH	99		300 $pp \to p_f(K^+K^-)p_s$
1580 ± 80		[9] ALDE	98	GAM4	100 $\pi^-p \to \pi^0\pi^0n$
~ 1520		REYES	98	SPEC	800 $pp \to p_s p_f K^0_S K^0_S$
~ 1475		FRABETTI	97D	E687	$D_s^\pm \to \pi^\mp\pi^\pm\pi^\pm$
~ 1505		ABELE	96	CBAR	0.0 $\overline{p}p \to 5\pi^0$
1460 ± 20	120	[9] AMELIN	96B	VES	37 $\pi^-A \to \eta\eta\pi^-A$
1500 ± 8		BUGG	96	RVUE	
1500 ± 15		[12] AMSLER	95B	CBAR	0.0 $\overline{p}p \to 3\pi^0$
1505 ± 15		[13] AMSLER	95C	CBAR	0.0 $\overline{p}p \to \eta\eta\pi^0$
1445 ± 5		[14] ANTINORI	95	OMEG	300,450 $pp \to pp2(\pi^+\pi^-)$
1497 ± 30		[9] ANTINORI	95	OMEG	300,450 $pp \to pp\pi^+\pi^-$
~ 1505		BUGG	95	MRK3	$J/\psi \to \gamma\pi^+\pi^-\pi^+\pi^-$

1446 ± 5		[9] ABATZIS	94	OMEG	450 $pp \to pp2(\pi^+\pi^-)$
1545 ±25		[9] AMSLER	94E	CBAR	0.0 $\overline{p}p \to \pi^0\eta\eta'$
1560 ±25		[9] AMSLER	92	CBAR	0.0 $\overline{p}p \to \pi^0\eta\eta$
1550 ±45 ± 30		[9] BELADIDZE	92C	VES	36 π^- Be $\to \pi^-\eta'\eta$ Be
1449 ± 4		[9] ARMSTRONG	89E	OMEG	300 $pp \to pp2(\pi^+\pi^-)$
1610 ±20		[9] ALDE	88	GAM4	300 $\pi^- N \to \pi^- N 2\eta$
~ 1525		ASTON	88D	LASS	11 $K^- p \to K^0_S K^0_S \Lambda$
1570 ±20	600	[9] ALDE	87	GAM4	100 $\pi^- p \to 4\pi^0 n$
1575 ±45		[15] ALDE	86D	GAM4	100 $\pi^- p \to 2\eta n$
1568 ±33		[9] BINON	84C	GAM2	38 $\pi^- p \to \eta\eta' n$
1592 ±25		[9] BINON	83	GAM2	38 $\pi^- p \to 2\eta n$
1525 ± 5		[9] GRAY	83	DBC	0.0 $\overline{p}N \to 3\pi$

[1] Breit-Wigner mass.
[2] The $\pi^+\pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass $1540.2 \pm 7.0^{+36.3}_{-6.1}$ MeV and width $157 \pm 19^{+11}_{-77}$ MeV.
[3] Using CLEO-c data but not authored by the CLEO Collaboration.
[4] From a fit to a Breit-Wigner line shape with fixed $\Gamma = 109$ MeV.
[5] Solution I, statistical error only.
[6] From partial wave analysis including all possible combinations of 0^{++}, 2^{++}, and 4^{++} resonances.
[7] Reanalysis of AITALA 01A data. This state could also be $f_0(1370)$.
[8] Breit-Wigner mass. May also be the $f_0(1370)$.
[9] Breit-Wigner mass.
[10] Statistical error only.
[11] Breit-Wigner, solution 1, PWA ambiguous.
[12] T-matrix pole, supersedes ANISOVICH 94.
[13] T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.
[14] Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.
[15] From central value and spread of two solutions. Breit-Wigner mass.

$f_0(1500)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
108± 33		[1] BERTIN	98	OBLX	0.05–0.405 $\overline{n}p \to \pi^+\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$107 \pm 9^{+21}_{-7}$		[2] ABLIKIM	22G	BES3	$J/\psi \to \gamma\pi^+\pi^-\eta'$
124± 7		[3] AAIJ	14BR	LHCB	$\overline{B}^0_s \to J/\psi\pi^+\pi^-$
$136^{+41}_{-26}{}^{+28}_{-100}$	5.5k	[4] ABLIKIM	13N	BES3	$e^+e^- \to J/\psi \to \gamma\eta\eta$
$90^{+2}_{-1}{}^{+50}_{-22}$		[5] UEHARA	08A	BELL	10.6 $e^+e^- \to e^+e^-\pi^0\pi^0$
$108^{+14}_{-11} \pm 25$		[6] ABLIKIM	06V	BES2	$e^+e^- \to J/\psi \to \gamma\pi^+\pi^-$
121± 8		AMSLER	06	CBAR	0.9 $\overline{p}p \to K^+K^-\pi^0$
257± 33	9.9k	AUBERT	06O	BABR	$B^+ \to K^+K^+K^-$
108± 9	80k	[6,7] UMAN	06	E835	5.2 $\overline{p}p \to \eta\eta\pi^0$
119± 10		VLADIMIRSK...	06	SPEC	40 $\pi^- p \to K^0_S K^0_S n$

90±15		[6] BINON	05	GAMS	33 $\pi^- p \to \eta\eta n$
136±23	1400	[8] GARMASH	05	BELL	$B^+ \to K^+ K^+ K^-$
140±40		[6] ABELE	01	CBAR	0.0 $\overline{p} d \to \pi^- 4\pi^0 p$
104±25		[6] BARBERIS	99	OMEG	450 $p p \to p_s p_f K^+ K^-$
131±15		[6] BARBERIS	99B	OMEG	450 $p p \to p_s p_f \pi^+ \pi^-$
160±50		[6] BELLAZZINI	99	GAM4	450 $p p \to p p \pi^0 \pi^0$
100±33		[6] FRENCH	99		300 $p p \to p_f (K^+ K^-) p_s$
280±100		[6] ALDE	98	GAM4	100 $\pi^- p \to \pi^0 \pi^0 n$
∼ 100		FRABETTI	97D	E687	$D_s^\pm \to \pi^\mp \pi^\pm \pi^\pm$
∼ 169		ABELE	96	CBAR	0.0 $\overline{p} p \to 5\pi^0$
100±30	120	[6] AMELIN	96B	VES	37 $\pi^- A \to \eta\eta\pi^- A$
132±15		BUGG	96	RVUE	
120±25		[9] AMSLER	95B	CBAR	0.0 $\overline{p} p \to 3\pi^0$
120±30		[10] AMSLER	95C	CBAR	0.0 $\overline{p} p \to \eta\eta\pi^0$
65±10		[11] ANTINORI	95	OMEG	300,450 $p p \to p p 2(\pi^+ \pi^-)$
199±30		[6] ANTINORI	95	OMEG	300,450 $p p \to p p \pi^+ \pi^-$
56±12		[6] ABATZIS	94	OMEG	450 $p p \to p p 2(\pi^+ \pi^-)$
100±40		[6] AMSLER	94E	CBAR	0.0 $\overline{p} p \to \pi^0 \eta\eta'$
245±50		[6] AMSLER	92	CBAR	0.0 $\overline{p} p \to \pi^0 \eta\eta$
153±67±50		[6] BELADIDZE	92C	VES	36 π^- Be $\to \pi^- \eta' \eta$ Be
78±18		[6] ARMSTRONG	89E	OMEG	300 $p p \to p p 2(\pi^+ \pi^-)$
170±40		[6] ALDE	88	GAM4	300 $\pi^- N \to \pi^- N 2\eta$
150±20	600	[6] ALDE	87	GAM4	100 $\pi^- p \to 4\pi^0 n$
265±65		[12] ALDE	86D	GAM4	100 $\pi^- p \to 2\eta n$
260±60		[6] BINON	84C	GAM2	38 $\pi^- p \to \eta\eta' n$
210±40		[6] BINON	83	GAM2	38 $\pi^- p \to 2\eta n$
101±13		[6] GRAY	83	DBC	0.0 $\overline{p} N \to 3\pi$

[1] Breit-Wigner width.
[2] The $\pi^+\pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass $1540.2 \pm 7.0^{+36.3}_{-\ 6.1}$ MeV and width $157 \pm 19^{+11}_{-77}$ MeV.
[3] Solution I, statistical error only.
[4] From partial wave analysis including all possible combinations of 0^{++}, 2^{++}, and 4^{++} resonances.
[5] Breit-Wigner width. May also be the $f_0(1370)$.
[6] Breit-Wigner width.
[7] Statistical error only.
[8] Breit-Wigner, solution 1, PWA ambiguous.
[9] T-matrix pole, supersedes ANISOVICH 94.
[10] T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.
[11] Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.
[12] From central value and spread of two solutions. Breit-Wigner mass.

$f_0(1500)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1	$\pi\pi$	(34.5±2.2) %	1.2
Γ_2	$\pi^+\pi^-$	seen	
Γ_3	$2\pi^0$	seen	
Γ_4	4π	(48.9±3.3) %	1.2
Γ_5	$4\pi^0$	seen	
Γ_6	$2\pi^+2\pi^-$	seen	
Γ_7	$2(\pi\pi)_{S\text{-wave}}$	seen	
Γ_8	$\rho\rho$	seen	
Γ_9	$\pi(1300)\pi$	seen	
Γ_{10}	$a_1(1260)\pi$	seen	
Γ_{11}	$\eta\eta$	(6.0±0.9) %	1.1
Γ_{12}	$\eta\eta'(958)$	(2.2±0.8) %	1.4
Γ_{13}	$K\overline{K}$	(8.5±1.0) %	1.1
Γ_{14}	$\gamma\gamma$	not seen	

CONSTRAINED FIT INFORMATION

An overall fit to 6 branching ratios uses 10 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 =$ 5.6 for 6 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle\delta x_i \delta x_j\right\rangle/(\delta x_i \cdot \delta x_j)$, in percent, from the fit to 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_1	x_4	x_{11}	x_{12}
x_4	−88			
x_{11}	27	−56		
x_{12}	3	−32	26	
x_{13}	43	−64	20	2

$f_0(1500)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ — $\Gamma_1\Gamma_{14}/\Gamma$

VALUE (eV)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$33^{+12}_{-6}{}^{+1809}_{-21}$		[1] UEHARA	08A	BELL	10.6 $e^+e^- \to e^+e^-\pi^0\pi^0$
not seen		ACCIARRI	01H	L3	$\gamma\gamma \to K^0_S K^0_S$, E^{ee}_{cm}= 91, 183–209 GeV
<460	95	BARATE	00E	ALEP	$\gamma\gamma \to \pi^+\pi^-$

[1] May also be the $f_0(1370)$. Multiplied by us by 3 to obtain the $\pi\pi$ value.

$f_0(1500)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{total}$ — Γ_1/Γ

VALUE	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.454±0.104	BUGG	96	RVUE

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ — Γ_2/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	BERTIN	98	OBLX	0.05–0.405 $\overline{n}p \to \pi^+\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
possibly seen	FRABETTI	97D	E687	$D_s^\pm \to \pi^\mp\pi^\pm\pi^\pm$

$\Gamma(4\pi)/\Gamma(\pi\pi)$ — Γ_4/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
1.42±0.18 OUR FIT Error includes scale factor of 1.2.				
1.42±0.18 OUR AVERAGE Error includes scale factor of 1.2.				
1.37±0.16	BARBERIS	00D		450 $pp \to p_f 4\pi p_s$
2.1 ±0.6	[1] AMSLER	98	RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.1 ±0.2	[2] ANISOVICH	02D	SPEC	Combined fit
3.4 ±0.8	[1] ABELE	96	CBAR	0.0 $\overline{p}p \to 5\pi^0$

[1] Excluding $\rho\rho$ contribution to 4π.

[2] From a combined K-matrix analysis of Crystal Barrel (0. $p\overline{p} \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$), GAMS ($\pi p \to \pi^0\pi^0 n$, $\eta\eta n$, $\eta\eta' n$), and BNL ($\pi p \to K\overline{K}n$) data.

$\Gamma(2(\pi\pi)_{S\text{-wave}})/\Gamma(\pi\pi)$ — Γ_7/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.42±0.26	[1] ABELE	01	CBAR	0.0 $\overline{p}d \to \pi^- 4\pi^0 p$

[1] From the combined data of ABELE 96 and ABELE 96C.

$\Gamma(2(\pi\pi)_{S\text{-wave}})/\Gamma(4\pi)$ — Γ_7/Γ_4

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.26±0.07	ABELE	01B	CBAR	0.0 $\overline{p}d \to 5\pi p$

$\Gamma(\rho\rho)/\Gamma(4\pi)$ — Γ_8/Γ_4

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.13±0.08	ABELE	01B	CBAR	0.0 $\overline{p}d \to 5\pi p$

$\Gamma(\rho\rho)/\Gamma(2(\pi\pi)_{S\text{-wave}})$ — Γ_8/Γ_7

VALUE	DOCUMENT ID		COMMENT
2.87±0.34 OUR AVERAGE Error includes scale factor of 1.1.			
3.3 ±0.5	BARBERIS	00C	450 $pp \to p_f \pi^+\pi^- 2\pi^0 p_s$
2.6 ±0.4	BARBERIS	00C	450 $pp \to p_f 2(\pi^+\pi^-) p_s$

$\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_9/Γ_4

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.50 ± 0.25	ABELE	01B	CBAR	0.0 $\overline{p}d \to 5\pi p$

$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_{10}/Γ_4

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.12 ± 0.05	ABELE	01B	CBAR	0.0 $\overline{p}d \to 5\pi p$

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
large	ALDE	88	GAM4	300 $\pi^- N \to \eta\eta\pi^- N$
large	BINON	83	GAM2	38 $\pi^- p \to 2\eta n$

$\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_{11}/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.173±0.024 OUR FIT Error includes scale factor of 1.1.				
0.175±0.027 OUR AVERAGE				
0.18 ± 0.03	BARBERIS	00E		450 $pp \to p_f \eta\eta p_s$
0.157 ± 0.060	[1] AMSLER	95D	CBAR	0.0 $\overline{p}p \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.080 ± 0.033	AMSLER	02	CBAR	0.9 $\overline{p}p \to \pi^0\eta\eta$, $\pi^0\pi^0\pi^0$
0.11 ± 0.03	[2] ANISOVICH	02D	SPEC	Combined fit
0.078 ± 0.013	[3] ABELE	96C	RVUE	Compilation
0.230 ± 0.097	[4] AMSLER	95C	CBAR	0.0 $\overline{p}p \to \eta\eta\pi^0$

[1] Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
[2] From a combined K-matrix analysis of Crystal Barrel (0. $p\overline{p} \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$), GAMS ($\pi p \to \pi^0\pi^0 n$, $\eta\eta n$, $\eta\eta' n$), and BNL ($\pi p \to K\overline{K} n$) data.
[3] 2π width determined to be 60 ± 12 MeV.
[4] Using AMSLER 95B ($3\pi^0$).

$\Gamma(4\pi^0)/\Gamma(\eta\eta)$ Γ_5/Γ_{11}

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.8 ± 0.3	ALDE	87	GAM4	100 $\pi^- p \to 4\pi^0 n$

$\Gamma(\eta\eta'(958))/\Gamma(\pi\pi)$ Γ_{12}/Γ_1

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
6.4±2.2 OUR FIT Error includes scale factor of 1.4.				
9.5±2.6	BARBERIS	00A		450 $pp \to p_f \eta\eta p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$16.6^{+4.2}_{-4.0}$	[1] ABLIKIM	22AS	BES3	$J/\psi(1S) \to \gamma\eta\eta'$
0.5 ± 0.3	[2] ANISOVICH	02D	SPEC	Combined fit

[1] From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \to \eta\eta'$ P-wave.
[2] From a combined K-matrix analysis of Crystal Barrel (0. $p\overline{p} \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$), GAMS ($\pi p \to \pi^0\pi^0 n$, $\eta\eta n$, $\eta\eta' n$), and BNL ($\pi p \to K\overline{K} n$) data.

$\Gamma(\eta\eta'(958))/\Gamma(\eta\eta)$ — Γ_{12}/Γ_{11}

VALUE	DOCUMENT ID		TECN	COMMENT
0.37±0.13 OUR FIT Error includes scale factor of 1.5.				
0.29±0.10	[1] AMSLER	95C	CBAR	0.0 $\overline{p}p \to \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.05±0.03	[2] ANISOVICH	02D	SPEC	Combined fit
0.84±0.23	ABELE	96C	RVUE	Compilation
2.7 ±0.8	BINON	84C	GAM2	38 $\pi^- p \to \eta\eta' n$

[1] Using AMSLER 94E ($\eta\eta'\pi^0$).

[2] From a combined K-matrix analysis of Crystal Barrel (0. $p\overline{p} \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$), GAMS ($\pi p \to \pi^0\pi^0 n$, $\eta\eta n$, $\eta\eta' n$), and BNL ($\pi p \to K\overline{K} n$) data.

$\Gamma(K\overline{K})/\Gamma_{total}$ — Γ_{13}/Γ

VALUE	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.044±0.021	BUGG	96	RVUE

$\Gamma(K\overline{K})/\Gamma(\pi\pi)$ — Γ_{13}/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.246±0.025 OUR FIT				
0.236±0.026 OUR AVERAGE				
0.25 ±0.03	[1] BARGIOTTI	03	OBLX	$\overline{p}p$
0.19 ±0.07	[2] ABELE	98	CBAR	0.0 $\overline{p}p \to K^0_L K^\pm \pi^\mp$
0.20 ±0.08	[3] ABELE	96B	CBAR	0.0 $\overline{p}p \to \pi^0 K^0_L K^0_L$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.16 ±0.05	[4] ANISOVICH	02D	SPEC	Combined fit
0.33 ±0.03 ±0.07	BARBERIS	99D	OMEG	450 $pp \to K^+K^-$, $\pi^+\pi^-$

[1] Coupled channel analysis of $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, and $K^\pm K^0_S\pi^\mp$.

[2] Using $\pi^0\pi^0$ from AMSLER 95B.

[3] Using AMSLER 95B ($3\pi^0$), AMSLER 94C ($2\pi^0\eta$) and SU(3).

[4] From a combined K-matrix analysis of Crystal Barrel (0. $p\overline{p} \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$), GAMS ($\pi p \to \pi^0\pi^0 n$, $\eta\eta n$, $\eta\eta' n$), and BNL ($\pi p \to K\overline{K} n$) data.

$\Gamma(K\overline{K})/\Gamma(\eta\eta)$ — Γ_{13}/Γ_{11}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
1.43±0.24 OUR FIT Error includes scale factor of 1.1.					
1.85±0.41		BARBERIS	00E		450 $pp \to p_f \eta\eta p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.5 ±0.6		[1] ANISOVICH	02D	SPEC	Combined fit
<0.4	90	[2] PROKOSHKIN	91	GAM4	300 $\pi^- p \to \pi^- p\eta\eta$
<0.6		[3] BINON	83	GAM2	38 $\pi^- p \to 2\eta n$

[1] From a combined K-matrix analysis of Crystal Barrel (0. $p\overline{p} \to \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$), GAMS ($\pi p \to \pi^0\pi^0 n$, $\eta\eta n$, $\eta\eta' n$), and BNL ($\pi p \to K\overline{K} n$) data.

[2] Combining results of GAM4 with those of WA76 on $K\overline{K}$ central production.

[3] Using ETKIN 82B and COHEN 80.

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Also		PR D107 079901 (errat.)	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	22G	PRL 129 042001	M. Ablikim *et al.*	(BESIII Collab.)
RODAS	22	EPJ C82 80	A. Rodas *et al.*	(JPAC Collab.)
SARANTSEV	21	PL B816 136227	A.V. Sarantsev *et al.*	(BONN, PNPI)
ALBRECHT	20	EPJ C80 453	M. Albrecht *et al.*	(Crystal Barrel Collab.)
ABLIKIM	18AA	PR D98 072003	M. Ablikim *et al.*	(BESIII Collab.)
ROPERTZ	18	EPJ C78 1000	S. Ropertz, C. Hanhart, B. Kubis	(BONN, JULI)
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DOBBS	15	PR D91 052006	S. Dobbs *et al.*	(NWES)
AAIJ	14BR	PR D89 092006	R. Aaij *et al.*	(LHCb Collab.)
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ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)
KLEMPT	08	EPJ C55 39	E. Klempt, M. Matveev, A.V. Sarantsev	(BONN+)
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UMAN	06	PR D73 052009	I. Uman *et al.*	(FNAL E835)
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		Translated from YAF 69 515.		
BINON	05	PAN 68 960	F. Binon *et al.*	
		Translated from YAF 68 998.		
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BARGIOTTI	03	EPJ C26 371	M. Bargiotti *et al.*	(OBELIX Collab.)
AMSLER	02	EPJ C23 29	C. Amsler *et al.*	(Crystal Barrel Collab.)
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ACCIARRI	01H	PL B501 173	M. Acciarri *et al.*	(L3 Collab.)
AITALA	01A	PRL 86 765	E.M. Aitala *et al.*	(FNAL E791 Collab.)
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BUGG	96	NP B471 59	D.V. Bugg, A.V. Sarantsev, B.S. Zou	(LOQM, PNPI)
AMSLER	95B	PL B342 433	C. Amsler *et al.*	(Crystal Barrel Collab.)
AMSLER	95C	PL B353 571	C. Amsler *et al.*	(Crystal Barrel Collab.)
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BUGG	95	PL B353 378	D.V. Bugg *et al.*	(LOQM, PNPI, WASH)
ABATZIS	94	PL B324 509	S. Abatzis *et al.*	(ATHU, BARI, BIRM+)

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ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
ALDE	88	PL B201 160	D.M. Alde *et al.*	(SERP, BELG, LANL, LAPP+)
ASTON	88D	NP B301 525	D. Aston *et al.*	(SLAC, NAGO, CINC, INUS)
ALDE	87	PL B198 286	D.M. Alde *et al.*	(LANL, BRUX, SERP, LAPP)
ALDE	86D	NP B269 485	D.M. Alde *et al.*	(BELG, LAPP, SERP, CERN+)
LONGACRE	86	PL B177 223	R.S. Longacre *et al.*	(BNL, BRAN, CUNY+)
BINON	84C	NC 80A 363	F.G. Binon *et al.*	(BELG, LAPP, SERP+)
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ETKIN	82B	PR D25 1786	A. Etkin *et al.*	(BNL, CUNY, TUFTS, VAND)
COHEN	80	PR D22 2595	D. Cohen *et al.*	(ANL)
HYAMS	75	NP B100 205	B.D. Hyams *et al.*	(CERN, MPIM)