

# $f_0(1500)$

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

See also the mini-reviews on scalar mesons under  $f_0(600)$  and on non- $q\bar{q}$  candidates. (See the index for the page number.)

## $f_0(1500)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1507 ± 5 OUR AVERAGE</b>	Error	includes scale factor of 1.2.		
1515 ± 12	1	BARBERIS	00A	450 $pp \rightarrow p_f \eta \eta p_S$
1511 ± 9	1,2	BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_S$
1510 ± 8	1	BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_S$
1522 ± 25		BERTIN	98 OBLX	0.05–0.405 $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1449 ± 20	1	BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
1515 ± 20		ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
1500 ± 15	3	AMSLER	95B CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
1505 ± 15	4	AMSLER	95C CBAR	0.0 $\bar{p}p \rightarrow \eta \eta \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1490 ± 30	5	ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$
1497 ± 10	5	BARBERIS	99 OMEG	450 $pp \rightarrow p_S p_f K^+ K^-$
1502 ± 10	5	BARBERIS	99B OMEG	450 $pp \rightarrow p_S p_f \pi^+ \pi^-$
1502 ± 12 ± 10	6	BARBERIS	99D OMEG	450 $pp \rightarrow K^+ K^-$ , $\pi^+ \pi^-$
1530 ± 45	5	BELLAZZINI	99 GAM4	450 $pp \rightarrow pp \pi^0 \pi^0$
1505 ± 18	5	FRENCH	99	300 $pp \rightarrow p_f (K^+ K^-) p_S$
1447 ± 27	7	KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
1580 ± 80	5	ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
1499 ± 8	1	ANISOVICH	98B RVUE	Compilation
~ 1520		REYES	98 SPEC	800 $pp \rightarrow p_S p_f K_S^0 K_S^0$
1510 ± 20	1	BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
~ 1475		FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$
~ 1505		ABELE	96 CBAR	0.0 $\bar{p}p \rightarrow 5\pi^0$
1500 ± 8	1	ABELE	96C RVUE	Compilation
1460 ± 20	5	AMELIN	96B VES	37 $\pi^- A \rightarrow \eta \eta \pi^- A$
1500 ± 8		BUGG	96 RVUE	
1500 ± 10	8	AMSLER	95D CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0$ , $\pi^0 \eta \eta, \pi^0 \pi^0 \eta$
1445 ± 5	9	ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1497 ± 30	5	ANTINORI	95 OMEG	300,450 $pp \rightarrow pp\pi^+ \pi^-$
~ 1505		BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1446 ± 5	5	ABATZIS	94 OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$

1545 ± 25		<sup>5</sup> AMSLER	94E CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \eta \eta'$
1520 ± 25		<sup>1,10</sup> ANISOVICH	94 CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta \eta$
1505 ± 20		<sup>1,11</sup> BUGG	94 RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta \eta \pi^0,$ $\eta \pi^0 \pi^0$
1560 ± 25		<sup>5</sup> AMSLER	92 CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \eta \eta$
1550 ± 45 ± 30		<sup>5</sup> BELADIDZE	92C VES	36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
1449 ± 4		<sup>5</sup> ARMSTRONG	89E OMEG	300 $pp \rightarrow$ $pp2(\pi^+ \pi^-)$
1610 ± 20		<sup>5</sup> ALDE	88 GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$
~ 1525		ASTON	88D LASS	11 $K^- p \rightarrow K_S^0 K_S^0 \Lambda$
1570 ± 20	600	<sup>5</sup> ALDE	87 GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$
1575 ± 45		<sup>12</sup> ALDE	86D GAM4	100 $\pi^- p \rightarrow 2\eta n$
1568 ± 33		<sup>5</sup> BINON	84C GAM2	38 $\pi^- p \rightarrow \eta \eta' n$
1592 ± 25		<sup>5</sup> BINON	83 GAM2	38 $\pi^- p \rightarrow 2\eta n$
1525 ± 5		<sup>5</sup> GRAY	83 DBC	0.0 $\bar{p}N \rightarrow 3\pi$

<sup>1</sup> T-matrix pole.

<sup>2</sup> Average between  $\pi^+ \pi^- 2\pi^0$  and  $2(\pi^+ \pi^-)$ .

<sup>3</sup> T-matrix pole, supersedes ANISOVICH 94.

<sup>4</sup> T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.

<sup>5</sup> Breit-Wigner mass.

<sup>6</sup> Supersedes BARBERIS 99 and BARBERIS 99B.

<sup>7</sup> T-matrix pole on sheet  $--+$ .

<sup>8</sup> T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

<sup>9</sup> Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.

<sup>10</sup> From a simultaneous analysis of the annihilations  $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta \eta$ .

<sup>11</sup> Reanalysis of ANISOVICH 94 data.

<sup>12</sup> From central value and spread of two solutions. Breit-Wigner mass.

### $f_0(1500)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>109 ± 7</b>	<b>OUR AVERAGE</b>			
110 ± 24		<sup>13</sup> BARBERIS	00A	450 $pp \rightarrow p_f \eta \eta p_s$
102 ± 18		<sup>13,14</sup> BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
110 ± 16		<sup>13</sup> BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_s$
108 ± 33		BERTIN	98 OBLX	0.05–0.405 $\bar{p}p \rightarrow$ $\pi^+ \pi^+ \pi^-$
114 ± 30		<sup>13</sup> BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
105 ± 15		ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
120 ± 25		<sup>15</sup> AMSLER	95B CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
120 ± 30		<sup>16</sup> AMSLER	95C CBAR	0.0 $\bar{p}p \rightarrow \eta \eta \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
140 ± 40		<sup>17</sup> ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$
104 ± 25		<sup>17</sup> BARBERIS	99 OMEG	450 $pp \rightarrow$ $p_s p_f K^+ K^-$
131 ± 15		<sup>17</sup> BARBERIS	99B OMEG	450 $pp \rightarrow p_s p_f \pi^+ \pi^-$
98 ± 18 ± 16		<sup>18</sup> BARBERIS	99D OMEG	450 $pp \rightarrow K^+ K^-,$ $\pi^+ \pi^-$
160 ± 50		<sup>17</sup> BELLAZZINI	99 GAM4	450 $pp \rightarrow pp \pi^0 \pi^0$
100 ± 33		<sup>17</sup> FRENCH	99	300 $pp \rightarrow$ $p_f (K^+ K^-) p_s$

108 ± 46		19 KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
280 ± 100		20 ALDE	98 GAM4	$100 \pi^- p \rightarrow \pi^0 \pi^0 n$
130 ± 20		13 ANISOVICH	98B RVUE	Compilation
120 ± 35		13 BARBERIS	97B OMEG	$450 pp \rightarrow$ $pp2(\pi^+ \pi^-)$
~ 100		FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$
~ 169		ABELE	96 CBAR	$0.0 \bar{p}p \rightarrow 5\pi^0$
100 ± 30	120	17 AMELIN	96B VES	$37 \pi^- A \rightarrow \eta\eta\pi^- A$
132 ± 15		BUGG	96 RVUE	
154 ± 30		21 AMSLER	95D CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0,$ $\pi^0 \eta\eta, \pi^0 \pi^0 \eta$
65 ± 10		22 ANTINORI	95 OMEG	$300,450 pp \rightarrow$ $pp2(\pi^+ \pi^-)$
199 ± 30		17 ANTINORI	95 OMEG	$300,450 pp \rightarrow$ $pp\pi^+ \pi^-$
56 ± 12		17 ABATZIS	94 OMEG	$450 pp \rightarrow$ $pp2(\pi^+ \pi^-)$
100 ± 40		17 AMSLER	94E CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \eta\eta'$
148 <sup>+</sup> <sub>-</sub> 20 25	13,23	ANISOVICH	94 CBAR	$0.0 \bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta$
150 ± 20	13,24	BUGG	94 RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0,$ $\eta\pi^0 \pi^0$
245 ± 50		17 AMSLER	92 CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \eta\eta$
153 ± 67 ± 50		17 BELADIDZE	92C VES	$36 \pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
78 ± 18		17 ARMSTRONG	89E OMEG	$300 pp \rightarrow$ $pp2(\pi^+ \pi^-)$
170 ± 40		17 ALDE	88 GAM4	$300 \pi^- N \rightarrow \pi^- N 2\eta$
150 ± 20	600	17 ALDE	87 GAM4	$100 \pi^- p \rightarrow 4\pi^0 n$
265 ± 65		25 ALDE	86D GAM4	$100 \pi^- p \rightarrow 2\eta n$
260 ± 60		17 BINON	84C GAM2	$38 \pi^- p \rightarrow \eta\eta' n$
210 ± 40		17 BINON	83 GAM2	$38 \pi^- p \rightarrow 2\eta n$
101 ± 13		17 GRAY	83 DBC	$0.0 \bar{p}N \rightarrow 3\pi$

13 T-matrix pole.  
 14 Average between  $\pi^+ \pi^- 2\pi^0$  and  $2(\pi^+ \pi^-)$ .  
 15 T-matrix pole, supersedes ANISOVICH 94.  
 16 T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.  
 17 Breit-Wigner width.  
 18 Supersedes BARBERIS 99 and BARBERIS 99B.  
 19 T-matrix pole on sheet -- +.  
 20 Breit-Wigner width.  
 21 T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.  
 22 Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.  
 23 From a simultaneous analysis of the annihilations  $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta$ .  
 24 Reanalysis of ANISOVICH 94 data.  
 25 From central value and spread of two solutions. Breit-Wigner mass.

## $f_0(1500)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $\eta\eta'(958)$	seen
$\Gamma_2$ $\eta\eta$	seen
$\Gamma_3$ $4\pi$	seen
$\Gamma_4$ $4\pi^0$	seen
$\Gamma_5$ $2\pi^+2\pi^-$	seen
$\Gamma_6$ $2(\pi\pi)_{S\text{-wave}}$	
$\Gamma_7$ $\rho\rho$	
$\Gamma_8$ $\pi(1300)\pi$	
$\Gamma_9$ $a_1(1260)\pi$	
$\Gamma_{10}$ $\pi\pi$	seen
$\Gamma_{11}$ $\pi^+\pi^-$	seen
$\Gamma_{12}$ $2\pi^0$	seen
$\Gamma_{13}$ $K\bar{K}$	seen
$\Gamma_{14}$ $\gamma\gamma$	not seen

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

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{10}\Gamma_{14}/\Gamma$			
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$
<0.46	95	BARATE	00E ALEP	$\gamma\gamma \rightarrow \pi^+\pi^-$

### $f_0(1500)$ BRANCHING RATIOS

$\Gamma(\eta\eta'(958))/\Gamma(\eta\eta)$	$\Gamma_1/\Gamma_2$		
VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.29±0.10</b>	26	AMSLER	95C CBAR 0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$

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

0.84±0.23	ABELE	96C RVUE	Compilation
2.7 ±0.8	BINON	84C GAM2	38 $\pi^- p \rightarrow \eta\eta' n$

$\Gamma(\eta\eta'(958))/\Gamma(\pi\pi)$	$\Gamma_1/\Gamma_{10}$	
VALUE	DOCUMENT ID	COMMENT
<b>0.095±0.026</b>	BARBERIS	00A 450 $p p \rightarrow p_f \eta \eta p_s$

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$	$\Gamma_2/\Gamma$		
VALUE	DOCUMENT ID	TECN	COMMENT

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

large	ALDE	88	GAM4 300 $\pi^- N \rightarrow \eta\eta\pi^- N$
large	BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

### $\Gamma(4\pi^0)/\Gamma(\eta\eta)$

$\Gamma_4/\Gamma_2$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.8 \pm 0.3$	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

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

$\Gamma_7/\Gamma_6$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>COMMENT</u>
$3.3 \pm 0.5$	BARBERIS	00C 450 $\rho\rho \rightarrow \rho_f \pi^+ \pi^- 2\pi^0 p_S$
$2.6 \pm 0.4$	BARBERIS	00C 450 $\rho\rho \rightarrow \rho_f 2(\pi^+ \pi^-) p_S$

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

$\Gamma_6/\Gamma_3$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.26 \pm 0.07$	ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

### $\Gamma(\rho\rho)/\Gamma(4\pi)$

$\Gamma_7/\Gamma_3$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.13 \pm 0.08$	ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

### $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$

$\Gamma_8/\Gamma_3$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.50 \pm 0.25$	ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

### $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$

$\Gamma_9/\Gamma_3$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.12 \pm 0.05$	ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

### $\Gamma(2\pi^0)/\Gamma(\eta\eta)$

$\Gamma_{12}/\Gamma_2$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>1.7 \pm 0.8</math> OUR AVERAGE</b>	Error includes scale factor of 1.5.		
$4.17 \pm 1.74$	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta\eta,$ $\pi^0 \pi^0 \pi^0$
$1.45 \pm 0.61$	27 AMSLER	95C	CBAR 0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
$4.29 \pm 0.72$	28 ABELE	96C	RVUE Compilation
$2.12 \pm 0.81$	29 AMSLER	95D	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0,$ $\pi^0 \eta\eta, \pi^0 \pi^0 \eta$
$< 0.3$	BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

### $\Gamma(K\bar{K})/\Gamma(\eta\eta)$

$\Gamma_{13}/\Gamma_2$

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>1.85 \pm 0.41</math></b>		BARBERIS	00E	450 $\rho\rho \rightarrow \rho_f \eta\eta p_S$
$< 0.4$	90	30 PROKOSHKIN	91	GAM4 300 $\pi^- p \rightarrow \pi^- p \eta\eta$
$< 0.6$		31 BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$   $\Gamma_{13}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>
0.044 ± 0.021	BUGG	96 RVUE

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

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$   $\Gamma_{13}/\Gamma_{10}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.19 ± 0.07</b>	32 ABELE	98 CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
0.33 ± 0.03 ± 0.07	BARBERIS	99D OMEG	450 $pp \rightarrow K^+ K^-$ ,
0.20 ± 0.08	33 ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^+ \pi^-$ $\pi^0 K_L^0 K_L^0$

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

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$   $\Gamma_{10}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>
0.454 ± 0.104	BUGG	96 RVUE

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

$\Gamma(4\pi)/\Gamma(\pi\pi)$   $\Gamma_3/\Gamma_{10}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.37 ± 0.16	BARBERIS	00D	450 $pp \rightarrow \rho_f 4\pi p_S$
2.1 ± 0.6	34 AMSLER	98 RVUE	
3.4 ± 0.8	34 ABELE	96 CBAR	0.0 $\bar{p}p \rightarrow 5\pi^0$

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

$\Gamma(2(\pi\pi)_{\text{s-wave}})/\Gamma(\pi\pi)$   $\Gamma_6/\Gamma_{10}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.42 ± 0.26	35 ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$

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

$\Gamma(\pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{11}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
seen	BERTIN	98 OBLX	0.05–0.405 $\bar{p}p \rightarrow$
possibly seen	FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$

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

$\Gamma(\eta\eta)/\Gamma(\pi\pi)$   $\Gamma_2/\Gamma_{10}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>COMMENT</u>
<b>0.18 ± 0.03</b>	BARBERIS	00E 450 $pp \rightarrow \rho_f \eta \eta p_S$

<sup>26</sup> Using AMSLER 94E ( $\eta\eta' \pi^0$ ).

<sup>27</sup> Using AMSLER 95B ( $3\pi^0$ ).

<sup>28</sup>  $2\pi$  width determined to be  $60 \pm 12$  MeV.

<sup>29</sup> Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

<sup>30</sup> Combining results of GAM4 with those of WA76 on  $K\bar{K}$  central production.

<sup>31</sup> Using ETKIN 82B and COHEN 80.

<sup>32</sup> Using  $\pi^0 \pi^0$  from AMSLER 95B.

<sup>33</sup> Using AMSLER 95B ( $3\pi^0$ ), AMSLER 94C ( $2\pi^0 \eta$ ) and SU(3).

<sup>34</sup> Excluding  $\rho\rho$  contribution to  $4\pi$ .

<sup>35</sup> From the combined data of ABELE 96 and ABELE 96C.

## $f_0(1500)$ REFERENCES

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|------------|-----|--------------------------|---------------------------------------------|---------------------------|
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| ABELE      | 01  | EPJ C19 667              | A. Abele <i>et al.</i>                      | (Crystal Barrel Collab.)  |
| ABELE      | 01B | EPJ C21 261              | A. Abele <i>et al.</i>                      | (Crystal Barrel Collab.)  |
| ACCIARRI   | 01H | PL B501 173              | M. Acciarri <i>et al.</i>                   | (L3 Collab.)              |
| BARATE     | 00E | PL B472 189              | R. Barate <i>et al.</i>                     | (ALEPH Collab.)           |
| BARBERIS   | 00A | PL B471 429              | D. Barberis <i>et al.</i>                   | (WA 102 Collab.)          |
| BARBERIS   | 00C | PL B471 440              | D. Barberis <i>et al.</i>                   | (WA 102 Collab.)          |
| BARBERIS   | 00D | PL B474 423              | D. Barberis <i>et al.</i>                   | (WA 102 Collab.)          |
| BARBERIS   | 00E | PL B479 59               | D. Barberis <i>et al.</i>                   | (WA 102 Collab.)          |
| BARBERIS   | 99  | PL B453 305              | D. Barberis <i>et al.</i>                   | (Omega expt.)             |
| BARBERIS   | 99B | PL B453 316              | D. Barberis <i>et al.</i>                   | (Omega expt.)             |
| BARBERIS   | 99D | PL B462 462              | D. Barberis <i>et al.</i>                   | (Omega expt.)             |
| BELLAZZINI | 99  | PL B467 296              | R. Bellazzini <i>et al.</i>                 |                           |
| FRENCH     | 99  | PL B460 213              | B. French <i>et al.</i>                     | (WA76 Collab.)            |
| KAMINSKI   | 99  | EPJ C9 141               | R. Kaminski, L. Lesniak, B. Loiseau         | (CRAC, PARIN)             |
| ABELE      | 98  | PR D57 3860              | A. Abele <i>et al.</i>                      | (Crystal Barrel Collab.)  |
| ALDE       | 98  | EPJ A3 361               | D. Alde <i>et al.</i>                       | (GAM4 Collab.)            |
| Also       | 99  | PAN 62 405               | D. Alde <i>et al.</i>                       | (GAMS Collab.)            |
|            |     | Translated from YAF 62   | 446.                                        |                           |
| AMSLER     | 98  | RMP 70 1293              | C. Amsler                                   |                           |
| ANISOVICH  | 98B | UFN 41 419               | V.V. Anisovich <i>et al.</i>                |                           |
| BERTIN     | 98  | PR D57 55                | A. Bertin <i>et al.</i>                     | (OBELIX Collab.)          |
| REYES      | 98  | PRL 81 4079              | M.A. Reyes <i>et al.</i>                    |                           |
| BARBERIS   | 97B | PL B413 217              | D. Barberis <i>et al.</i>                   | (WA 102 Collab.)          |
| BERTIN     | 97C | PL B408 476              | A. Bertin <i>et al.</i>                     | (OBELIX Collab.)          |
| FRABETTI   | 97D | PL B407 79               | P.L. Frabetti <i>et al.</i>                 | (FNAL E687 Collab.)       |
| ABELE      | 96  | PL B380 453              | A. Abele <i>et al.</i>                      | (Crystal Barrel Collab.)  |
| ABELE      | 96B | PL B385 425              | A. Abele <i>et al.</i>                      | (Crystal Barrel Collab.)  |
| ABELE      | 96C | NP A609 562              | A. Abele <i>et al.</i>                      | (Crystal Barrel Collab.)  |
| AMELIN     | 96B | PAN 59 976               | D.V. Amelin <i>et al.</i>                   | (SERP, TBIL)              |
|            |     | Translated from YAF 59   | 1021.                                       |                           |
| BUGG       | 96  | NP B471 59               | D.V. Bugg, A.V. Sarantsev, B.S. Zou         | (LOQM, PNPI)              |
| AMSLER     | 95B | PL B342 433              | C. Amsler <i>et al.</i>                     | (Crystal Barrel Collab.)  |
| AMSLER     | 95C | PL B353 571              | C. Amsler <i>et al.</i>                     | (Crystal Barrel Collab.)  |
| AMSLER     | 95D | PL B355 425              | C. Amsler <i>et al.</i>                     | (Crystal Barrel Collab.)  |
| ANTINORI   | 95  | PL B353 589              | F. Antinori <i>et al.</i>                   | (ATHU, BARI, BIRM+)       |
| BUGG       | 95  | PL B353 378              | D.V. Bugg <i>et al.</i>                     | (LOQM, PNPI, WASH)        |
| ABATZIS    | 94  | PL B324 509              | S. Abatzis <i>et al.</i>                    | (ATHU, BARI, BIRM+)       |
| AMSLER     | 94C | PL B327 425              | C. Amsler <i>et al.</i>                     | (Crystal Barrel Collab.)  |
| AMSLER     | 94D | PL B333 277              | C. Amsler <i>et al.</i>                     | (Crystal Barrel Collab.)  |
| AMSLER     | 94E | PL B340 259              | C. Amsler <i>et al.</i>                     | (Crystal Barrel Collab.)  |
| ANISOVICH  | 94  | PL B323 233              | V.V. Anisovich <i>et al.</i>                | (Crystal Barrel Collab.)  |
| BUGG       | 94  | PR D50 4412              | D.V. Bugg <i>et al.</i>                     | (LOQM)                    |
| AMSLER     | 92  | PL B291 347              | C. Amsler <i>et al.</i>                     | (Crystal Barrel Collab.)  |
| BELADIDZE  | 92C | SJNP 55 1535             | G.M. Beladidze, S.I. Bitjukov, G.V. Borisov | (SERP+)                   |
|            |     | Translated from YAF 55   | 2748.                                       |                           |
| PROKOSHKIN | 91  | SPD 36 155               | Y.D. Prokoshkin                             | (GAM2, GAM4 Collab.)      |
|            |     | Translated from DANS 316 | 900.                                        |                           |
| ARMSTRONG  | 89E | PL B228 536              | T.A. Armstrong, M. Benayoun                 | (ATHU, BARI, BIRM+)       |
| ALDE       | 88  | PL B201 160              | D.M. Alde <i>et al.</i>                     | (SERP, BELG, LANL, LAPP+) |
| ASTON      | 88D | NP B301 525              | D. Aston <i>et al.</i>                      | (SLAC, NAGO, CINC, INUS)  |
| ALDE       | 87  | PL B198 286              | D.M. Alde <i>et al.</i>                     | (LANL, BRUX, SERP, LAPP)  |
| ALDE       | 86D | NP B269 485              | D.M. Alde <i>et al.</i>                     | (BELG, LAPP, SERP, CERN+) |
| BINON      | 84C | NC 80A 363               | F.G. Binon <i>et al.</i>                    | (BELG, LAPP, SERP+)       |
| BINON      | 83  | NC 78A 313               | F.G. Binon <i>et al.</i>                    | (BELG, LAPP, SERP+)       |
| Also       | 83B | SJNP 38 561              | F.G. Binon <i>et al.</i>                    | (BELG, LAPP, SERP+)       |
|            |     | Translated from YAF 38   | 934.                                        |                           |
| GRAY       | 83  | PR D27 307               | L. Gray <i>et al.</i>                       | (SYRA)                    |
| ETKIN      | 82B | PR D25 1786              | A. Etkin <i>et al.</i>                      | (BNL, CUNY, TUFTS, VAND)  |
| COHEN      | 80  | PR D22 2595              | D. Cohen <i>et al.</i>                      | (ANL)                     |

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