$\rho(1450)$

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

See our mini-review under the $\rho(1700)$.

$\rho(1450)$ MASS

VALUE (MeV)	DOCUMENT ID
1465±25 OUR ESTIMATE	This is only an educated guess; the error given is larger than the error on the average of the published values.

$\eta\rho^0$ MODE

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1497±14	[1] AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1421±15	[2] AKHMETSHIN	00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1470±20	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1446±10	FUKUI	88	SPEC	$8.95\ \pi^- p \rightarrow \eta\pi^+\pi^- n$

[1] Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

[2] Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

$\omega\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1582±17±25	2382	[3] AKHMETSHIN	03B	CMD2	$e^+e \rightarrow \pi^0\pi^0\gamma$
$1349\pm25^{+10}_{-5}$	341	[4] ALEXANDER	01B	CLE2	$B \rightarrow D^{(*)}\omega\pi^-$
1523±10		[5] EDWARDS	00A	CLE2	$\tau^- \rightarrow \omega\pi^-\nu_\tau$
1463±25		[6] CLEGG	94	RVUE	
1250		[7] ASTON	80C	OMEG	20–70 $\gamma p \rightarrow \omega\pi^0 p$
1290±40		[7] BARBER	80C	SPEC	3–5 $\gamma p \rightarrow \omega\pi^0 p$

[3] Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

[4] Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

[5] Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

[6] Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

[7] Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

4π MODE

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1435±40	ABELE	01B	CBAR	$0.0\ \overline{p}n \rightarrow 2\pi^-2\pi^0\pi^+$
1350±50	ACHASOV	97	RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1449± 4	[8] ARMSTRONG	89E	OMEG	$300\ pp \rightarrow pp2(\pi^+\pi^-)$

[8] Not clear whether this observation has I=1 or 0.

$\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1328±15		[9] SCHAEL	05C	ALEP	$\tau^- \to \pi^- \pi^0 \nu_\tau$
1406±15	87k	[10,11] ANDERSON	00A	CLE2	$\tau^- \to \pi^- \pi^0 \nu_\tau$
∼ 1368		[12] ABELE	99C	CBAR	0.0 $\overline{p} d \to \pi^+ \pi^- \pi^- p$
1348±33		BERTIN	98	OBLX	0.05–0.405 $\overline{n} p \to \pi^+ \pi^+ \pi^-$
1411±14		[13] ABELE	97	CBAR	$\overline{p} n \to \pi^- \pi^0 \pi^0$
1370^{+90}_{-70}		ACHASOV	97	RVUE	$e^+ e^- \to \pi^+ \pi^-$
1359±40		[11] BERTIN	97C	OBLX	0.0 $\overline{p} p \to \pi^+ \pi^- \pi^0$
1282±37		BERTIN	97D	OBLX	0.05 $\overline{p} p \to 2\pi^+ 2\pi^-$
1424±25		BISELLO	89	DM2	$e^+ e^- \to \pi^+ \pi^-$
1292±17		[14] KURDADZE	83	OLYA	0.64–1.4 $e^+ e^- \to \pi^+ \pi^-$

[9] From the combined fit of the τ^- data from ANDERSON 00A and SCHAEL 05C and $e^+ e^-$ data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. $\rho(1700)$ mass and width fixed at 1713 MeV and 235 MeV, respectively. Supersedes BARATE 97M.
[10] From the GOUNARIS 68 parametrization of the pion form factor.
[11] $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.
[12] $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.
[13] T-matrix pole.
[14] Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

$\phi\pi$ MODE

VALUE (MeV)	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1480±40	[15,16] BITYUKOV	87	SPEC	0	32.5 $\pi^- p \to \phi\pi^0 n$

[15] DONNACHIE 91 suggests this is a different particle.
[16] Not seen by ABELE 97H.

$K\overline{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1422.8±6.5	27k	[17] ABELE	99D	CBAR	±	0.0 $\overline{p} p \to K^+ K^- \pi^0$

[17] K-matrix pole. Isospin not determined, could be $\omega(1420)$.

MIXED MODES

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1265.5±75.3	DUBNICKA	89	RVUE	$e^+ e^- \to \pi^+ \pi^-$

$\rho(1450)$ WIDTH

VALUE (MeV)	DOCUMENT ID

400±60 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

$\eta\rho^0$ MODE

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
226±44	[18] AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
211±31	[19] AKHMETSHIN	00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
230±30	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
60±15	FUKUI	88	SPEC	8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

[18] Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

[19] Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

$\omega\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
429± 42±10	2382	[20] AKHMETSHIN	03B	CMD2	$e^+e \rightarrow \pi^0\pi^0\gamma$
547± 86^{+46}_{-45}	341	[21] ALEXANDER	01B	CLE2	$B \rightarrow D^{(*)}\omega\pi^-$
400± 35		[22] EDWARDS	00A	CLE2	$\tau^- \rightarrow \omega\pi^-\nu_\tau$
311± 62		[23] CLEGG	94	RVUE	
300		[24] ASTON	80C	OMEG	20–70 $\gamma p \rightarrow \omega\pi^0 p$
320±100		[24] BARBER	80C	SPEC	3–5 $\gamma p \rightarrow \omega\pi^0 p$

[20] Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

[21] Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

[22] Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

[23] Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

[24] Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

4π MODE

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
325±100	ABELE	01B	CBAR	0.0 $\overline{p} n \rightarrow 2\pi^- 2\pi^0 \pi^+$

$\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
468±41		[25] SCHAEL	05C	ALEP	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
455±41	87k	[26,27] ANDERSON	00A	CLE2	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
~ 374		[28] ABELE	99C	CBAR	0.0 $\overline{p} d \rightarrow \pi^+\pi^-\pi^- p$
275±10		BERTIN	98	OBLX	0.05–0.405 $\overline{n} p \rightarrow \pi^+\pi^+\pi^-$
343±20		[29] ABELE	97	CBAR	$\overline{p} n \rightarrow \pi^-\pi^0\pi^0$
310±40		[27] BERTIN	97C	OBLX	0.0 $\overline{p} p \rightarrow \pi^+\pi^-\pi^0$
236±36		BERTIN	97D	OBLX	0.05 $\overline{p} p \rightarrow 2\pi^+ 2\pi^-$
269±31		BISELLO	89	DM2	$e^+e^- \rightarrow \pi^+\pi^-$
218±46		[30] KURDADZE	83	OLYA	0.64–1.4 $e^+e^- \rightarrow \pi^+\pi^-$

[25] From the combined fit of the τ^- data from ANDERSON 00A and SCHAEL 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. $\rho(1700)$ mass and width fixed at 1713 MeV and 235 MeV, respectively. Supersedes BARATE 97M.
[26] From the GOUNARIS 68 parametrization of the pion form factor.
[27] $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.
[28] $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.
[29] T-matrix pole.
[30] Using for $\rho(1700)$ mass and width 1600 $\pm$ 20 and 300 $\pm$ 10 MeV respectively.

$\phi\pi$ MODE

VALUE (MeV)	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
130±60	[31,32] BITYUKOV	87	SPEC	0	32.5 $\pi^- p \rightarrow \phi\pi^0 n$

[31] DONNACHIE 91 suggests this is a different particle.
[32] Not seen by ABELE 97H.

$K\overline{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
146.5±10.5	27k	[33] ABELE	99D	CBAR	±	0.0 $\overline{p}p \rightarrow K^+K^-\pi^0$

[33] K-matrix pole. Isospin not determined, could be $\omega(1420)$.

MIXED MODES

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
391±70	DUBNICKA	89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$

$\rho(1450)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\pi\pi$	seen
Γ_2	4π	seen
Γ_3	$\omega\pi$	
Γ_4	$a_1(1260)\pi$	
Γ_5	$h_1(1170)\pi$	
Γ_6	$\pi(1300)\pi$	
Γ_7	$\rho\rho$	
Γ_8	$\rho(\pi\pi)_{S\text{-wave}}$	
Γ_9	e^+e^-	seen
Γ_{10}	$\eta\rho$	possibly seen
Γ_{11}	$a_2(1320)\pi$	not seen
Γ_{12}	$\phi\pi$	possibly seen
Γ_{13}	$K\overline{K}$	not seen
Γ_{14}	$K\overline{K}^*(892)$+ c.c.	possibly seen
Γ_{15}	$\eta\gamma$	possibly seen

$\rho(1450)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\mathrm{total})$

$\Gamma(\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\mathrm{total}}$ — $\Gamma_1\Gamma_9/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.12	[34] DIEKMAN	88	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
$0.027^{+0.015}_{-0.010}$	[35] KURDADZE	83	OLYA	0.64–1.4 $e^+e^- \rightarrow \pi^+\pi^-$

$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{\mathrm{total}}$ — $\Gamma_{10}\Gamma_9/\Gamma$

VALUE (eV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
74 ± 20	[36] AKHMETSHIN	00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
91 ± 19	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$

$\Gamma(\phi\pi) \times \Gamma(e^+e^-)/\Gamma_{\mathrm{total}}$ — $\Gamma_{12}\Gamma_9/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<70	90	[37] AULCHENKO	87B	ND	$e^+e^- \rightarrow K^0_S K^0_L \pi^0$

$\Gamma(\eta\gamma) \times \Gamma(e^+e^-)/\Gamma_{\mathrm{total}}$ — $\Gamma_{15}\Gamma_9/\Gamma$

VALUE (units 10^{-9})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$2.9^{+2.8}_{-1.9}\pm0.1$	33k	[38] ACHASOV	06A	SND	$e^+e^- \rightarrow \eta\gamma$
<41.1		[39] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \rightarrow \eta\gamma$
$10.0\pm2.2\pm1.5$		[40] AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$

[34] Using total width = 235 MeV.
[35] Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.
[36] Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.
[37] Using mass 1480 ± 40 MeV and total width 130 ± 60 MeV of BITYUKOV 87.
[38] From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0)/B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Using 1465 MeV for the $\rho(1450)$ mass and 400 MeV for its width. Recalculated by us from the cross section at the peak.
[39] From 2γ decay mode of η using 1465 MeV and 310 MeV for the $\rho(1450)$ mass and width.
[40] Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

$\rho(1450)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma(4\pi)$ — Γ_1/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.37 ± 0.10	[41,42] ABELE	01B	CBAR	0.0 $\overline{p}n \rightarrow 5\pi$

$\Gamma(\omega\pi)/\Gamma_{total}$ — Γ_3/Γ

VALUE	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.21	CLEGG	94	RVUE

$\Gamma(\pi\pi)/\Gamma(\omega\pi)$ — Γ_1/Γ_3

VALUE	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.32	CLEGG	94	RVUE

$\Gamma(\omega\pi)/\Gamma(4\pi)$ — Γ_3/Γ_2

VALUE	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.14	CLEGG	88	RVUE

$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ — Γ_4/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.27 ± 0.08	[41] ABELE	01B	CBAR	$0.0\ \overline{p}n \to 5\pi$

$\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$ — Γ_5/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.08 ± 0.04	[41] ABELE	01B	CBAR	$0.0\ \overline{p}n \to 5\pi$

$\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ — Γ_6/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.37 ± 0.13	[41] ABELE	01B	CBAR	$0.0\ \overline{p}n \to 5\pi$

$\Gamma(\rho\rho)/\Gamma(4\pi)$ — Γ_7/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.11 ± 0.05	[41] ABELE	01B	CBAR	$0.0\ \overline{p}n \to 5\pi$

$\Gamma(\rho(\pi\pi)_{S\text{-wave}})/\Gamma(4\pi)$ — Γ_8/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.17 ± 0.09	[41] ABELE	01B	CBAR	$0.0\ \overline{p}n \to 5\pi$

$\Gamma(\eta\rho)/\Gamma_{total}$ — Γ_{10}/Γ

VALUE	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.04	DONNACHIE	87B	RVUE

$\Gamma(\eta\rho)/\Gamma(\omega\pi)$ — Γ_{10}/Γ_3

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.24	[43] DONNACHIE	91	RVUE	
>2	FUKUI	91	SPEC	8.95 $\pi^- p \to \omega\pi^0 n$

$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ — Γ_{11}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	AMELIN	00	VES	37 $\pi^- p \to \eta\pi^+\pi^- n$

$\Gamma(\phi\pi)/\Gamma_{\text{total}}$ — Γ_{12}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	ABELE	97H	CBAR	$\overline{p}p \to K^0_L K^0_S \pi^0\pi^0$
<0.01	[43] DONNACHIE	91	RVUE	

$\Gamma(\phi\pi)/\Gamma(\omega\pi)$ — Γ_{12}/Γ_3

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
>0.5	95	BITYUKOV	87	SPEC	0	32.5 $\pi^- p \to \phi\pi^0 n$

$\Gamma(K\overline{K})/\Gamma(\omega\pi)$ — Γ_{13}/Γ_3

VALUE	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.08	[43] DONNACHIE	91	RVUE

$\Gamma(K\overline{K}^*(892)+\text{c.c.})/\Gamma_{\text{total}}$ — Γ_{14}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
possibly seen	COAN	04	CLEO	$\tau^- \to K^-\pi^- K^+ \nu_\tau$

[41] $\omega\pi$ not included.
[42] Using ABELE 97.
[43] Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

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