$\rho(770)$

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

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$\rho(770)$ MASS

We no longer list *S*-wave Breit-Wigner fits, or data with high combinatorial background.

NEUTRAL ONLY, e^+e^-

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
775.49±0.34 OUR AVERAGE					
775.97±0.46±0.70	900k	[1] AKHMETSHIN	07		$e^+e^- \to \pi^+\pi^-$
774.6 ±0.4 ±0.5	800k	[2,3] ACHASOV	06	SND	$e^+e^- \to \pi^+\pi^-$
775.65±0.64±0.50	114k	[4,5] AKHMETSHIN	04	CMD2	$e^+e^- \to \pi^+\pi^-$
775.9 ±0.5 ±0.5	1.98M	[6] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
775.8 ±0.9 ±2.0	500k	[6] ACHASOV	02	SND	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
775.9 ±1.1		[7] BARKOV	85	OLYA	$e^+e^- \to \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
775.8 ±0.5 ±0.3	1.98M	[8] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
775.9 ±0.6 ±0.5	1.98M	[9] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
775.0 ±0.6 ±1.1	500k	[10] ACHASOV	02	SND	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
775.1 ±0.7 ±5.3		[11] BENAYOUN	98	RVUE	$e^+e^- \to \pi^+\pi^-$, $\mu^+\mu^-$
770.5 ±1.9 ±5.1		[12] GARDNER	98	RVUE	0.28–0.92 $e^+e^- \to \pi^+\pi^-$
764.1 ±0.7		[13] O'CONNELL	97	RVUE	$e^+e^- \to \pi^+\pi^-$
757.5 ±1.5		[14] BERNICHA	94	RVUE	$e^+e^- \to \pi^+\pi^-$
768 ±1		[15] GESHKEN...	89	RVUE	$e^+e^- \to \pi^+\pi^-$

CHARGED ONLY, τ DECAYS and e^+e^-

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
775.11±0.34 OUR AVERAGE						
774.6 ±0.2 ±0.5	5.4M	[16,17] FUJIKAWA	08	BELL	±	$\tau^- \to \pi^-\pi^0\nu_\tau$
775.5 ±0.7		[17,18] SCHAEL	05C	ALEP		$\tau^- \to \pi^-\pi^0\nu_\tau$
775.5 ±0.5 ±0.4	1.98M	[6] ALOISIO	03	KLOE		1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
775.1 ±1.1 ±0.5	87k	[19,20] ANDERSON	00A	CLE2		$\tau^- \to \pi^-\pi^0\nu_\tau$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
774.8 ±0.6 ±0.4	1.98M	[9] ALOISIO	03	KLOE	−	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
776.3 ±0.6 ±0.7	1.98M	[9] ALOISIO	03	KLOE	+	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
773.9 ±2.0 $^{+0.3}_{-1.0}$		[21] SANZ-CILLERO	03	RVUE		$\tau^- \to \pi^-\pi^0\nu_\tau$
774.5 ±0.7 ±1.5	500k	[6] ACHASOV	02	SND	±	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
775.1 ±0.5		[22] PICH	01	RVUE		$\tau^- \to \pi^-\pi^0\nu_\tau$

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
763.0±0.3±1.2	600k	[23] ABELE	99E	CBAR	0±	0.0 $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$

CHARGED ONLY, HADROPRODUCED

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
766.5±1.1 OUR AVERAGE						
763.7±3.2		ABELE	97	CBAR		$\overline{p}n \rightarrow \pi^-\pi^0\pi^0$
768 ±9		AGUILAR-...	91	EHS		400 pp
767 ±3	2935	[24] CAPRARO	87	SPEC	−	200 π^- Cu → $\pi^-\pi^0$ Cu
761 ±5	967	[24] CAPRARO	87	SPEC	−	200 π^- Pb → $\pi^-\pi^0$ Pb
771 ±4		HUSTON	86	SPEC	+	202 π^+ A → $\pi^+\pi^0$ A
766 ±7	6500	[25] BYERLY	73	OSPK	−	5 π^-p
766.8±1.5	9650	[26] PISUT	68	RVUE	−	1.7–3.2 π^-p, t <10
767 ±6	900	[24] EISNER	67	HBC	−	4.2 π^-p, t <10

NEUTRAL ONLY, PHOTOPRODUCED

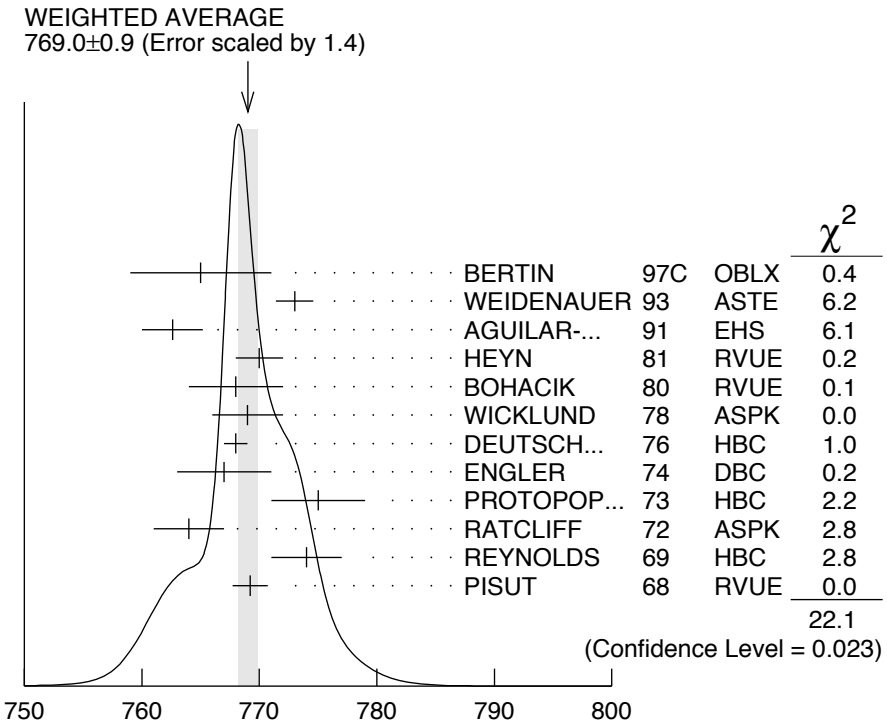
VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
768.5± 1.1 OUR AVERAGE						
770 ± 2 ±1	79k	[27] BREITWEG	98B	ZEUS	0	50–100 γp
767.6± 2.7		BARTALUCCI	78	CNTR	0	$\gamma p \rightarrow e^+e^-p$
775 ± 5		GLADDING	73	CNTR	0	2.9–4.7 γp
767 ± 4	1930	BALLAM	72	HBC	0	2.8 γp
770 ± 4	2430	BALLAM	72	HBC	0	4.7 γp
765 ±10		ALVENSLEB...	70	CNTR	0	γA, t <0.01
767.7± 1.9	140k	BIGGS	70	CNTR	0	<4.1 γC → $\pi^+\pi^-$C
765 ± 5	4000	ASBURY	67B	CNTR	0	γ + Pb
• • • We do not use the following data for averages, fits, limits, etc. • • •						
771 ± 2	79k	[28] BREITWEG	98B	ZEUS	0	50–100 γp

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
769.0±0.9 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.					
765 ±6		BERTIN	97C	OBLX		0.0 $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$
773 ±1.6		WEIDENAUER	93	ASTE		$\overline{p}p \rightarrow \pi^+\pi^-\omega$
762.6±2.6		AGUILAR-...	91	EHS		400 pp
770 ±2		[29] HEYN	81	RVUE		Pion form factor
768 ±4		[30,31] BOHACIK	80	RVUE	0	
769 ±3		[25] WICKLUND	78	ASPK	0	3,4,6 $\pi^\pm N$
768 ±1	76000	DEUTSCH...	76	HBC	0	16 π^+p
767 ±4	4100	ENGLER	74	DBC	0	6 $\pi^+n \rightarrow \pi^+\pi^-p$
775 ±4	32000	[30] PROTOPOP...	73	HBC	0	7.1 π^+p, t <0.4
764 ±3	6800	RATCLIFF	72	ASPK	0	15 π^-p, t <0.3
774 ±3	1700	REYNOLDS	69	HBC	0	2.26 π^-p
769.2±1.5	13300	[32] PISUT	68	RVUE	0	1.7–3.2 π^-p, t <10

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

773.5±2.5		[33]	COLANGELO	01	RVUE		$\pi\pi \rightarrow \pi\pi$
762.3±0.5±1.2	600k	[34]	ABELE	99E	CBAR	0	0.0 $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$
777 ±2	4943	[35]	ADAMS	97	E665		470 $\mu p \rightarrow \mu X B$
770 ±2		[36]	BOGOLYUB...	97	MIRA		32 $\overline{p}p \rightarrow \pi^+\pi^-$ X
768 ±8		[36]	BOGOLYUB...	97	MIRA		32 $pp \rightarrow \pi^+\pi^-$ X
761.1±2.9			DUBNICKA	89	RVUE		π form factor
777.4±2.0		[37]	CHABAUD	83	ASPK	0	17 $\pi^- p$ polarized
769.5±0.7		[30,31]	LANG	79	RVUE	0	
770 ±9		[31]	ESTABROOKS	74	RVUE	0	17 $\pi^- p \rightarrow \pi^+\pi^- n$
773.5±1.7	11200	[24]	JACOBS	72	HBC	0	2.8 $\pi^- p$
775 ±3	2250		HYAMS	68	OSPK	0	11.2 $\pi^- p$



[1] A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
[2] Supersedes ACHASOV 05A.
[3] A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.
[4] Using the GOUNARIS 68 parametrization with the complex phase of the ρ-ω interference.
[5] Update of AKHMETSHIN 02.
[6] Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
[7] From the GOUNARIS 68 parametrization of the pion form factor.
[8] Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.
[9] Without limitations on masses and widths.
[10] Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.
[11] Using the data of BARKOV 85 in the hidden local symmetry model.

[12] From the fit to $e^+e^- \to \pi^+\pi^-$ data from the compilations of HEYN 81 and BARKOV 85, including the GOUNARIS 68 parametrization of the pion form factor.
[13] A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
[14] Applying the S-matrix formalism to the BARKOV 85 data.
[15] Includes BARKOV 85 data. Model-dependent width definition.
[16] $|F_\pi(0)|^2$ fixed to 1.
[17] From the GOUNARIS 68 parametrization of the pion form factor.
[18] The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.
[19] $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.
[20] From the GOUNARIS 68 parametrization of the pion form factor. The second error is a model error taking into account different parametrizations of the pion form factor.
[21] Using the data of BARATE 97M and the effective chiral Lagrangian.
[22] From a fit of the model-independent parameterization of the pion form factor to the data of BARATE 97M.
[23] Assuming the equality of ρ^+ and ρ^- masses and widths.
[24] Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
[25] Phase shift analysis. Systematic errors added corresponding to spread of different fits.
[26] From fit of 3-parameter relativistic P-wave Breit-Wigner to total mass distribution. Includes BATON 68, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65 and CARMONY 64.
[27] From the parametrization according to SOEDING 66.
[28] From the parametrization according to ROSS 66.
[29] HEYN 81 includes all spacelike and timelike F_π values until 1978.
[30] From pole extrapolation.
[31] From phase shift analysis of GRAYER 74 data.
[32] Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDHABER 64, ABOLINS 63.
[33] Breit-Wigner mass from a phase-shift analysis of HYAMS 73 and PROTOPOPESCU 73 data.
[34] Using relativistic Breit-Wigner and taking into account ρ-ω interference.
[35] Systematic errors not evaluated.
[36] Systematic effects not studied.
[37] From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P-wave intensity. CHABAUD 83 includes data of GRAYER 74.

$m_{\rho(770)^0} - m_{\rho(770)^\pm}$

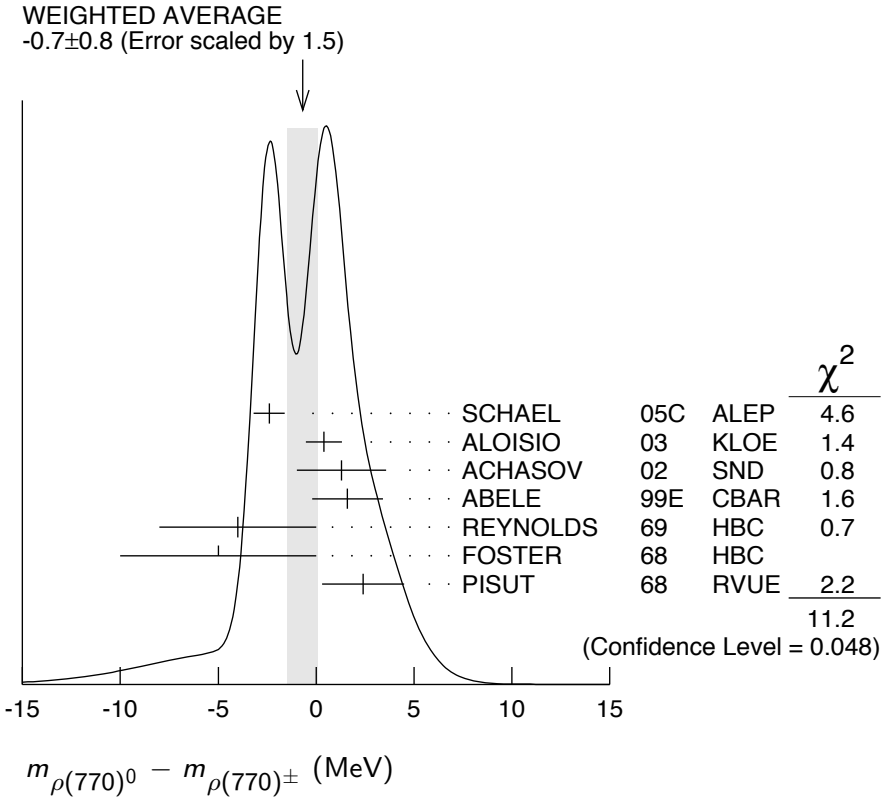
VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
-0.7 ± 0.8 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.					
-2.4 ± 0.8		[38] SCHAEL	05C	ALEP		$\tau^- \to \pi^-\pi^0\nu_\tau$
$0.4\pm0.7\pm0.6$	1.98M	[39] ALOISIO	03	KLOE		1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
$1.3\pm1.1\pm2.0$	500k	[39] ACHASOV	02	SND		1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
$1.6\pm0.6\pm1.7$	600k	ABELE	99E	CBAR	$0\pm$	0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$
-4 ± 4	3000	[40] REYNOLDS	69	HBC	-0	2.26 $\pi^- p$
-5 ± 5	3600	[40] FOSTER	68	HBC	±0	0.0 $\overline{p}p$
2.4 ± 2.1	22950	[41] PISUT	68	RVUE		$\pi N \to \rho N$

[38] 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. Supersedes BARATE 97M.

[39] Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

[40] From quoted masses of charged and neutral modes.

[41] Includes MALAMUD 69, ARMENISE 68, BATON 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65, CARMONY 64, GOLDHABER 64, ABOLINS 63.



$m_{\rho(770)^+} - m_{\rho(770)^-}$

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.5 \pm 0.8 \pm 0.7$	1.98M	[42] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$

[42] Without limitations on masses and widths.

$\rho(770)$ RANGE PARAMETER

The range parameter R enters an energy-dependent correction to the width, of the form $(1 + q_r^2\ R^2)\ /\ (1 + q^2\ R^2)$, where q is the momentum of one of the pions in the $\pi\pi$ rest system. At resonance, $q = q_r$.

VALUE (GeV^{-1})	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
$\mathbf{5.3^{+0.9}_{=0.7}}$	CHABAUD	83	ASPK	0	17 $\pi^- p$ polarized

$\rho(770)$ WIDTH

We no longer list S-wave Breit-Wigner fits, or data with high combinatorial background.

NEUTRAL ONLY, e^+e^-

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
146.2 ±0.7 OUR AVERAGE		Error includes scale factor of 1.1.				
145.98±0.75±0.50	900k	[43] AKHMETSHIN	07			$e^+e^- \to \pi^+\pi^-$
146.1 ±0.8 ±1.5	800k	[44,45] ACHASOV	06	SND		$e^+e^- \to \pi^+\pi^-$
143.85±1.33±0.80	114k	[46,47] AKHMETSHIN	04	CMD2		$e^+e^- \to \pi^+\pi^-$
147.3 ±1.5 ±0.7	1.98M	[48] ALOISIO	03	KLOE		1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
151.1 ±2.6 ±3.0	500k	[48] ACHASOV	02	SND	0	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
150.5 ±3.0		[49] BARKOV	85	OLYA	0	$e^+e^- \to \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
143.9 ±1.3 ±1.1	1.98M	[50] ALOISIO	03	KLOE		1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
147.4 ±1.5 ±0.7	1.98M	[51] ALOISIO	03	KLOE		1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
149.8 ±2.2 ±2.0	500k	[52] ACHASOV	02	SND		1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
147.9 ±1.5 ±7.5		[53] BENAYOUN	98	RVUE		$e^+e^- \to \pi^+\pi^-$, $\mu^+\mu^-$
153.5 ±1.3 ±4.6		[54] GARDNER	98	RVUE		0.28–0.92 $e^+e^- \to \pi^+\pi^-$
145.0 ±1.7		[55] O'CONNELL	97	RVUE		$e^+e^- \to \pi^+\pi^-$
142.5 ±3.5		[56] BERNICHA	94	RVUE		$e^+e^- \to \pi^+\pi^-$
138 ±1		[57] GESHKEN...	89	RVUE		$e^+e^- \to \pi^+\pi^-$

CHARGED ONLY, τ DECAYS and e^+e^-

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
149.1±0.8 OUR FIT						
149.1±0.8 OUR AVERAGE						
148.1±0.4±1.7	5.4M	[58,59] FUJIKAWA	08	BELL	±	$\tau^- \to \pi^-\pi^0\nu_\tau$
149.0±1.2		[59,60] SCHAEL	05C	ALEP		$\tau^- \to \pi^-\pi^0\nu_\tau$
149.9±2.3±2.0	500k	[48] ACHASOV	02	SND	±	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
150.4±1.4±1.4	87k	[61,62] ANDERSON	00A	CLE2		$\tau^- \to \pi^-\pi^0\nu_\tau$

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

143.7±1.3±1.2	1.98M	[48] ALOISIO	03	KLOE	±	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
142.9±1.3±1.4	1.98M	[51] ALOISIO	03	KLOE	−	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
144.7±1.4±1.2	1.98M	[51] ALOISIO	03	KLOE	+	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
$150.2\pm2.0^{+0.7}_{-1.6}$		[63] SANZ-CILLERO	03	RVUE		$\tau^- \to \pi^-\pi^0\nu_\tau$
150.9±2.2±2.0	500k	[52] ACHASOV	02	SND		1.02 $e^+e^- \to \pi^+\pi^-\pi^0$

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
149.5±1.3	600k	[64] ABELE	99E	CBAR	0±	0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$

CHARGED ONLY, HADROPRODUCED

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
150.2± 2.4 OUR FIT						
150.2± 2.4 OUR AVERAGE						
152.8± 4.3		ABELE	97	CBAR		$\overline{p}n \to \pi^-\pi^0\pi^0$
155 ±11	2935	[65] CAPRARO	87	SPEC	−	200 π^- Cu → $\pi^-\pi^0$ Cu
154 ±20	967	[65] CAPRARO	87	SPEC	−	200 π^- Pb → $\pi^-\pi^0$ Pb
150 ± 5		HUSTON	86	SPEC	+	202 π^+ A → $\pi^+\pi^0$ A
146 ±12	6500	[66] BYERLY	73	OSPK	−	5 $\pi^- p$
148.2± 4.1	9650	[67] PISUT	68	RVUE	−	1.7–3.2 $\pi^- p$, t <10
146 ±13	900	EISNER	67	HBC	−	4.2 $\pi^- p$, t <10

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
150.7± 2.9 OUR AVERAGE						
146 ± 3 ±13	79k	[68] BREITWEG	98B	ZEUS	0	50–100 γp
150.9± 3.0		BARTALUCCI	78	CNTR	0	$\gamma p \to e^+e^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
138 ± 3	79k	[69] BREITWEG	98B	ZEUS	0	50–100 γp
147 ±11		GLADDING	73	CNTR	0	2.9–4.7 γp
155 ±12	2430	BALLAM	72	HBC	0	4.7 γp
145 ±13	1930	BALLAM	72	HBC	0	2.8 γp
140 ± 5		ALVENSLEB...	70	CNTR	0	γA, t <0.01
146.1± 2.9	140k	BIGGS	70	CNTR	0	<4.1 γC → $\pi^+\pi^-$ C
160 ±10		LANZEROTTI	68	CNTR	0	γp
130 ± 5	4000	ASBURY	67B	CNTR	0	γ + Pb

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
150.9± 1.7 OUR AVERAGE	Error includes scale factor of 1.1.					
122 ±20		BERTIN	97C	OBLX		0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$
145.7± 5.3		WEIDENAUER	93	ASTE		$\overline{p}p \to \pi^+\pi^-\omega$
144.9± 3.7		DUBNICKA	89	RVUE		π form factor
148 ± 6	[70,71]	BOHACIK	80	RVUE	0	

152	± 9		[66]	WICKLUND	78	ASPK	0	3,4,6 $\pi^{\pm} p N$
154	± 2	76000		DEUTSCH...	76	HBC	0	16 $\pi^{+} p$
157	± 8	6800		RATCLIFF	72	ASPK	0	15 $\pi^{-} p$, t <0.3
143	± 8	1700		REYNOLDS	69	HBC	0	2.26 $\pi^{-} p$

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

147.0	± 2.5	600k	[72]	ABELE	99E	CBAR	0	0.0 $\overline{p}p \rightarrow \pi^{+}\pi^{-}\pi^{0}$
146	± 3	4943	[73]	ADAMS	97	E665		470 $\mu p \rightarrow \mu X B$
160.0	$^{+\ 4.1}_{-\ 4.0}$		[74]	CHABAUD	83	ASPK	0	17 $\pi^{-} p$ polarized
155	± 1		[75]	HEYN	81	RVUE	0	π form factor
148.0	± 1.3		[70,71]	LANG	79	RVUE	0	
146	±14	4100		ENGLER	74	DBC	0	6 $\pi^{+} n \rightarrow \pi^{+}\pi^{-} p$
143	±13		[71]	ESTABROOKS	74	RVUE	0	17 $\pi^{-} p \rightarrow \pi^{+}\pi^{-} n$
160	±10	32000	[70]	PROTOPOP...	73	HBC	0	7.1 $\pi^{+} p$, t <0.4
145	±12	2250	[65]	HYAMS	68	OSPK	0	11.2 $\pi^{-} p$
163	±15	13300	[76]	PISUT	68	RVUE	0	1.7–3.2 $\pi^{-} p$, t <10

[43] A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
[44] Supersedes ACHASOV 05A.
[45] A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.
[46] Using the GOUNARIS 68 parametrization with the complex phase of the ρ-ω interference.
[47] From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.
[48] Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
[49] From the GOUNARIS 68 parametrization of the pion form factor.
[50] Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.
[51] Without limitations on masses and widths.
[52] Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.
[53] Using the data of BARKOV 85 in the hidden local symmetry model.
[54] From the fit to $e^+e^- \rightarrow \pi^+\pi^-$ data from the compilations of HEYN 81 and BARKOV 85, including the GOUNARIS 68 parametrization of the pion form factor.
[55] A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
[56] Applying the S-matrix formalism to the BARKOV 85 data.
[57] Includes BARKOV 85 data. Model-dependent width definition.
[58] $|F_\pi(0)|^2$ fixed to 1.
[59] From the GOUNARIS 68 parametrization of the pion form factor.
[60] The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.
[61] $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.
[62] From the GOUNARIS 68 parametrization of the pion form factor. The second error is a model error taking into account different parametrizations of the pion form factor.
[63] Using the data of BARATE 97M and the effective chiral Lagrangian.
[64] Assuming the equality of ρ^+ and ρ^- masses and widths.
[65] Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
[66] Phase shift analysis. Systematic errors added corresponding to spread of different fits.
[67] From fit of 3-parameter relativistic P-wave Breit-Wigner to total mass distribution. Includes BATON 68, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65 and CARMONY 64.
[68] From the parametrization according to SOEDING 66.
[69] From the parametrization according to ROSS 66.
[70] From pole extrapolation.
[71] From phase shift analysis of GRAYER 74 data.

[72] Using relativistic Breit-Wigner and taking into account ρ-ω interference.
[73] Systematic errors not evaluated.
[74] From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P-wave intensity. CHABAUD 83 includes data of GRAYER 74.
[75] HEYN 81 includes all spacelike and timelike F_π values until 1978.
[76] Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDHABER 64, ABOLINS 63.

$\Gamma_{\rho(770)^0} - \Gamma_{\rho(770)^\pm}$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.3±1.3 OUR AVERAGE		Error includes scale factor of 1.4.			
-0.2 ± 1.0		[77] SCHAEL	05C	ALEP	$\tau^- \to \pi^-\pi^0\nu_\tau$
$3.6\pm1.8\pm1.7$	1.98M	[78] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma_{\rho(770)^+} - \Gamma_{\rho(770)^-}$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.8±2.0±0.5	1.98M	[79] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$

[77] 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. Supersedes BARATE 97M.
[78] Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
[79] Without limitations on masses and widths.

$\rho(770)$ DECAY MODES

	Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$\pi\pi$		$\sim$ 100	%
	$\rho(770)^\pm$ decays			
Γ_2	$\pi^\pm\pi^0$		$\sim$ 100	%
Γ_3	$\pi^\pm\gamma$		(4.5 ±0.5)	$\times 10^{-4}$ S=2.2
Γ_4	$\pi^\pm\eta$		$<$ 6	$\times 10^{-3}$ CL=84%
Γ_5	$\pi^\pm\pi^+\pi^-\pi^0$		$<$ 2.0	$\times 10^{-3}$ CL=84%
	$\rho(770)^0$ decays			
Γ_6	$\pi^+\pi^-$		$\sim$ 100	%
Γ_7	$\pi^+\pi^-\gamma$		(9.9 ±1.6)	$\times 10^{-3}$
Γ_8	$\pi^0\gamma$		(6.0 ±0.8)	$\times 10^{-4}$
Γ_9	$\eta\gamma$		(3.00±0.20)	$\times 10^{-4}$
Γ_{10}	$\pi^0\pi^0\gamma$		(4.5 ±0.8)	$\times 10^{-5}$
Γ_{11}	$\mu^+\mu^-$	[a]	(4.55±0.28)	$\times 10^{-5}$

Γ_{12}	$e^+ e^-$	[a]	(4.72 ± 0.05)	$\times 10^{-5}$
Γ_{13}	$\pi^+ \pi^- \pi^0$		($1.01^{+0.54}_{-0.36} \pm 0.34$)	$\times 10^{-4}$
Γ_{14}	$\pi^+ \pi^- \pi^+ \pi^-$		(1.8 ± 0.9)	$\times 10^{-5}$
Γ_{15}	$\pi^+ \pi^- \pi^0 \pi^0$		(1.6 ± 0.8)	$\times 10^{-5}$
Γ_{16}	$\pi^0 e^+ e^-$	<	1.2	$\times 10^{-5}$ CL=90%
Γ_{17}	$\eta e^+ e^-$			

[a] The $\omega\rho$ interference is then due to $\omega\rho$ mixing only, and is expected to be small. If $e\mu$ universality holds, $\Gamma(\rho^0 \to \mu^+ \mu^-) = \Gamma(\rho^0 \to e^+ e^-) \times 0.99785$.

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 10 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 10.7$ for 8 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_3	−100	
Γ	15	−15
	x_2	x_3

	Mode	Rate (MeV)	Scale factor
Γ_2	$\pi^\pm \pi^0$	150.2 ± 2.4	
Γ_3	$\pi^\pm \gamma$	0.068 ± 0.007	2.3

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 7 branching ratios uses 21 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 6.0$ for 13 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, $x_i \equiv \Gamma_i/\Gamma_{\rm total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

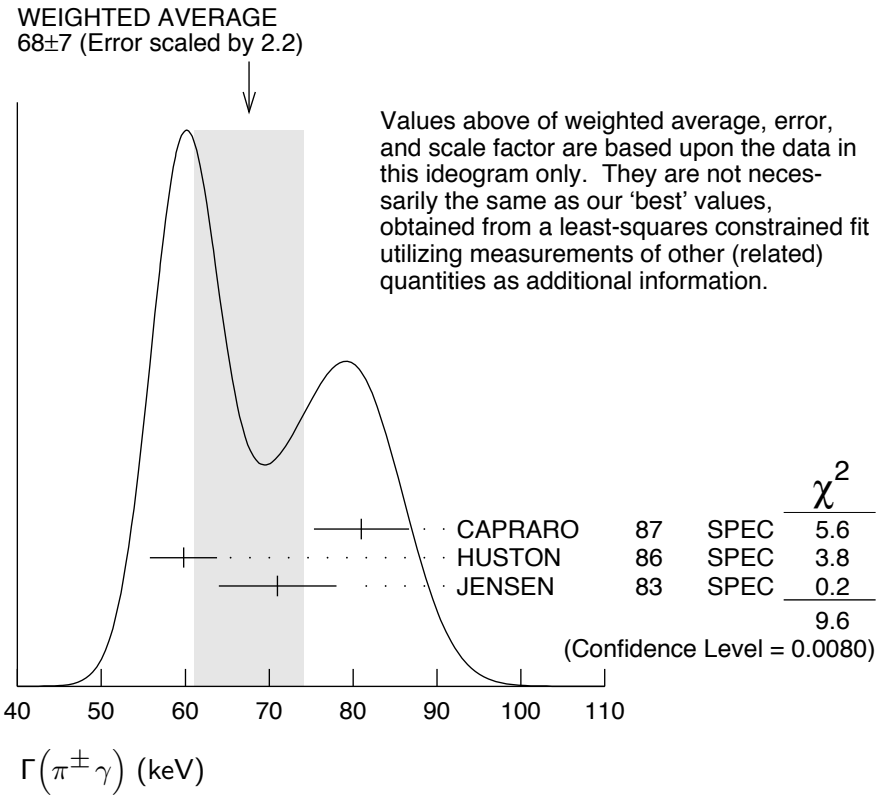
x_7	−100							
x_8	−5	0						
x_9	−1	0	1					
x_{10}	−1	0	0	0				
x_{11}	2	−3	0	0	0			
x_{12}	0	0	−8	−9	0	0		
x_{14}	−1	0	0	0	0	0	0	
Γ	0	0	4	5	0	0	−54	0
	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{14}

	Mode		Rate (MeV)	
Γ_6	$\pi^+\pi^-$		147.5	±0.9
Γ_7	$\pi^+\pi^-\gamma$		1.48	±0.24
Γ_8	$\pi^0\gamma$		0.089	±0.012
Γ_9	$\eta\gamma$		0.0447	±0.0031
Γ_{10}	$\pi^0\pi^0\gamma$		0.0066	±0.0012
Γ_{11}	$\mu^+\mu^-$	[a]	0.0068	±0.0004
Γ_{12}	e^+e^-	[a]	0.00704	±0.00006
Γ_{14}	$\pi^+\pi^-\pi^+\pi^-$		0.0027	±0.0014

$\rho(770)$ PARTIAL WIDTHS

$\Gamma(\pi^\pm\gamma)$ Γ_3

VALUE (keV)	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
68 ±7 OUR FIT Error includes scale factor of 2.3.					
68 ±7 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.					
81 ±4 ±4	CAPRARO	87	SPEC	−	200 π^- A → $\pi^-\pi^0$ A
59.8±4.0	HUSTON	86	SPEC	+	202 π^+ A → $\pi^+\pi^0$ A
71 ±7	JENSEN	83	SPEC	−	156–260 π^- A → $\pi^-\pi^0$ A



$\Gamma(e^+e^-)$ Γ_{12}

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
7.04 ±0.06 OUR FIT					
7.04 ±0.06 OUR AVERAGE					
7.048±0.057±0.050	900k	[80] AKHMETSHIN	07		$e^+e^- \to \pi^+\pi^-$
7.06 ±0.11 ±0.05	114k	[81,82] AKHMETSHIN	04	CMD2	$e^+e^- \to \pi^+\pi^-$
6.77 ±0.10 ±0.30		BARKOV	85	OLYA	$e^+e^- \to \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
7.12 ±0.02 ±0.11	800k	[83] ACHASOV	06	SND	$e^+e^- \to \pi^+\pi^-$
6.3 ±0.1		[84] BENAYOUN	98	RVUE	$e^+e^- \to \pi^+\pi^-$, $\mu^+\mu^-$

$\Gamma(\pi^0\gamma)$ Γ_8

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
77±17±11	36500	[85] ACHASOV	03	SND	0.60–0.97 $e^+e^- \to \pi^0\gamma$
121±31		DOLINSKY	89	ND	$e^+e^- \to \pi^0\gamma$

$\Gamma(\eta\gamma)$ Γ_9

VALUE (keV)	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
62±17	[86] DOLINSKY	89	ND	$e^+e^- \to \eta\gamma$

$\Gamma(\pi^+\pi^-\pi^+\pi^-)$ Γ_{14}

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$2.8\pm1.4\pm0.5$	153	AKHMETSHIN	00	CMD2	0.6–0.97 $e^+e^-\to\pi^+\pi^-\pi^+\pi^-$

[80] A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
[81] Using the GOUNARIS 68 parametrization with the complex phase of the ρ-ω interference.
[82] From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.
[83] Supersedes ACHASOV 05A.
[84] Using the data of BARKOV 85 in the hidden local symmetry model.
[85] Using $\Gamma_{\rm total}$= 147.9 ± 1.3 MeV and B($\rho\to\pi^0\gamma$) from ACHASOV 03.
[86] Solution corresponding to constructive ω-ρ interference.

$\rho(770)\ \Gamma(e^+e^-)\Gamma(i)/\Gamma^2(\text{total})$

$\Gamma(e^+e^-)/\Gamma_{\rm total}\times\Gamma(\pi^+\pi^-)/\Gamma_{\rm total}$ $\Gamma_{12}/\Gamma\times\Gamma_6/\Gamma$

VALUE (units 10^{-5})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$4.876\pm0.023\pm0.064$	800k	[87,88] ACHASOV	06	SND	$e^+e^-\to\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.72 ±0.02		[89] BENAYOUN	10	RVUE	0.4–1.05 e^+e^-

[87] Supersedes ACHASOV 05A.
[88] A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.
[89] A simultaneous fit of $e^+e^-\to\pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

$\Gamma(e^+e^-)/\Gamma_{\rm total}\times\Gamma(\eta\gamma)/\Gamma_{\rm total}$ $\Gamma_{12}/\Gamma\times\Gamma_9/\Gamma$

VALUE (units 10^{-8})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
(1.42+-0.10) OUR FIT					
(1.45+-0.12) OUR AVERAGE					
$1.32\pm0.14\pm0.08$	33k	[90] ACHASOV	07B	SND	0.6–1.38 $e^+e^-\to\eta\gamma$
$1.50\pm0.65\pm0.09$	17.4k	[91] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^-\to\eta\gamma$
$1.61\pm0.20\pm0.11$	23k	[92,93] AKHMETSHIN	01B	CMD2	$e^+e^-\to\eta\gamma$
1.85 ± 0.49		[94] DOLINSKY	89	ND	$e^+e^-\to\eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.05 ± 0.02		[95] BENAYOUN	10	RVUE	0.4–1.05 e^+e^-

[90] From a combined fit of $\sigma(e^+e^-\to\eta\gamma)$ with $\eta\to3\pi^0$ and $\eta\to\pi^+\pi^-\pi^0$, and fixing B($\eta\to3\pi^0$) / B($\eta\to\pi^+\pi^-\pi^0$) = 1.44 ± 0.04. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.
[91] From the $\eta\to2\gamma$ decay and using B($\eta\to\gamma\gamma$)= 39.43 ± 0.26%.
[92] From the $\eta\to3\pi^0$ decay and using B($\eta\to3\pi^0$)= (32.24 ± 0.29) × 10^{-2}.
[93] The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
[94] Recalculated by us from the cross section in the peak.
[95] A simultaneous fit of $e^+e^-\to\pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

$\Gamma(e^+e^-)/\Gamma_{total} \times \Gamma(\pi^0\gamma)/\Gamma_{total}$ $\Gamma_{12}/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID		TECN	COMMENT
(2.8+-0.4) OUR FIT					
(2.8+-0.4) OUR AVERAGE					
$2.90\ ^{+0.60}_{-0.55} \pm 0.18$	18680	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
$2.37 \pm 0.53 \pm 0.33$	36500	[96] ACHASOV	03	SND	0.60–0.97 $e^+e^- \to \pi^0\gamma$
$3.61 \pm 0.74 \pm 0.49$	10625	[97] DOLINSKY	89	ND	$e^+e^- \to \pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.875 ± 0.026		[98] BENAYOUN	10	RVUE	0.4–1.05 e^+e^-

[96] Using $\sigma_{\phi \to \pi^0\gamma}$ from ACHASOV 00 and m_ρ= 775.97 MeV in the model with the energy-independent phase of ρ-ω interference equal to $(-10.2 \pm 7.0)^\circ$.
[97] Recalculated by us from the cross section in the peak.
[98] A simultaneous fit of $e^+e^- \to \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

$\Gamma(e^+e^-)/\Gamma_{total} \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ $\Gamma_{12}/\Gamma \times \Gamma_{13}/\Gamma$

VALUE (units 10^{-9})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.903 ± 0.076		[99] BENAYOUN	10	RVUE	0.4–1.05 e^+e^-
$4.58\ ^{+2.46}_{-1.64} \pm 1.56$	1.2M	[100] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$

[99] A simultaneous fit of $e^+e^- \to \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.
[100] Statistical significance is less than 3σ.

$\rho(770)$ BRANCHING RATIOS

$\Gamma(\pi^\pm\eta)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	CHG	COMMENT
<60	84	FERBEL	66	HBC	$\pm$	$\pi^\pm p$ above 2.5

$\Gamma(\pi^\pm\pi^+\pi^-\pi^0)/\Gamma(\pi\pi)$ Γ_5/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	CHG	COMMENT
<20	84	FERBEL	66	HBC	$\pm$	$\pi^\pm p$ above 2.5
• • • We do not use the following data for averages, fits, limits, etc. • • •						
35 ± 40		JAMES	66	HBC	+	2.1 $\pi^+ p$

$\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-)$ Γ_{11}/Γ_6

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
(4.60+-0.28) OUR FIT				
$4.6 \pm 0.2 \pm 0.2$	ANTIPOV	89	SIGM	π^- Cu $\to \mu^+\mu^-\pi^-$ Cu
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$8.2^{+1.6}_{-3.6}$	[101] ROTHWELL	69	CNTR	Photoproduction
5.6 ± 1.5	[102] WEHMANN	69	OSPK	12 π^- C, Fe
$9.7^{+3.1}_{-3.3}$	[103] HYAMS	67	OSPK	11 π^- Li, H

$\Gamma(e^+e^-)/\Gamma(\pi\pi)$ Γ_{12}/Γ_1

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.40 ± 0.05	[104] BENAKSAS	72	OSPK	$e^+e^- \to \pi^+\pi^-$

$\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
(3.00+-0.21) OUR FIT						
(2.90+-0.32) OUR AVERAGE						
$2.79\pm0.34\pm0.03$	33k	[105] ACHASOV	07B	SND		0.6–1.38 $e^+e^- \to \eta\gamma$
$3.6\ \pm0.9$		[106] ANDREWS	77	CNTR	0	6.7–10 γ Cu
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$3.21\pm1.39\pm0.20$	17.4k	[107,108] AKHMETSHIN	05	CMD2		0.60-1.38 $e^+e^- \to \eta\gamma$
$3.39\pm0.42\pm0.23$		[106,109,110] AKHMETSHIN	01B	CMD2		$e^+e^- \to \eta\gamma$
$1.9\ ^{+0.6}_{-0.8}$		[111] BENAYOUN	96	RVUE		0.54-1.04 $e^+e^- \to \eta\gamma$
$4.0\ \pm1.1$		[106,108] DOLINSKY	89	ND		$e^+e^- \to \eta\gamma$

$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
(1.8+-0.9) OUR FIT					
$1.8\pm0.9\pm0.3$		153	AKHMETSHIN 00	CMD2	0.6–0.97 $e^+e^- \to \pi^+\pi^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<20	90		KURDADZE 88	OLYA	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-$

$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma(\pi\pi)$ Γ_{14}/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<15	90	ERBE	69	HBC	0	2.5–5.8 γp
<20		CHUNG	68	HBC	0	3.2,4.2 $\pi^- p$
<20	90	HUSON	68	HLBC	0	16.0 $\pi^- p$
<80		JAMES	66	HBC	0	2.1 $\pi^+ p$

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$1.01\ ^{+0.54}_{-0.36}\pm0.34$		1.2M	[112] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$
<1.2	90		VASSERMAN	88B	ND	$e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi\pi)$ Γ_{13}/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
~ 0.01		BRAMON	86	RVUE	0	$J/\psi \to \omega\pi^0$
<0.01	84	[113] ABRAMS	71	HBC	0	3.7 $\pi^+ p$

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{total}$ Γ_{15}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
1.60±0.74±0.18		[114] ACHASOV	09A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 4	90	AULCHENKO	87C	ND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
<20	90	KURDADZE	86	OLYA	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$

$\Gamma(\pi^+\pi^-\gamma)/\Gamma_{total}$ Γ_7/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
0.0099±0.0016 OUR FIT					
0.0099±0.0016		[115] DOLINSKY	91	ND	$e^+e^- \to \pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0111±0.0014		[116] VASSERMAN	88	ND	$e^+e^- \to \pi^+\pi^-\gamma$
<0.005	90	[117] VASSERMAN	88	ND	$e^+e^- \to \pi^+\pi^-\gamma$

$\Gamma(\pi^0\gamma)/\Gamma_{total}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$6.21^{+1.28}_{-1.18}\pm0.39$	18680	[118,119] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
5.22±1.17±0.75	36500	[119,120] ACHASOV	03	SND	0.60–0.97 $e^+e^- \to \pi^0\gamma$
6.8 ±1.7		[121] BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \to \pi^0\gamma$
7.9 ±2.0		[119] DOLINSKY	89	ND	$e^+e^- \to \pi^0\gamma$

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{total}$ Γ_{16}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<1.2	90	ACHASOV	08	SND	0.36–0.97 $e^+e^- \to \pi^0 e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.6		AKHMETSHIN	05A	CMD2	0.72-0.84 e^+e^-

$\Gamma(\eta e^+ e^-)/\Gamma_{total}$ Γ_{17}/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.7	AKHMETSHIN	05A	CMD2	0.72-0.84 e^+e^-

$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{total}$ Γ_{10}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
(4.5+-0.8) OUR FIT					
(4.5+0.9-0.8) OUR AVERAGE					
$5.2^{+1.5}_{-1.3}\pm0.6$	190	[122] AKHMETSHIN	04B	CMD2	0.6–0.97 $e^+e^- \to \pi^0\pi^0\gamma$
$4.1^{+1.0}_{-0.9}\pm0.3$	295	[123] ACHASOV	02F	SND	0.36–0.97 $e^+e^- \to \pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$4.8^{+3.4}_{-1.8}\pm0.5$	63	[124] ACHASOV	00G	SND	$e^+e^- \to \pi^0\pi^0\gamma$

[101] Possibly large ρ-ω interference leads us to increase the minus error.

[102] Result contains 11 $\pm$ 11% correction using SU(3) for central value. The error on the correction takes account of possible ρ-ω interference and the upper limit agrees with the upper limit of $\omega \to \mu^+\mu^-$ from this experiment.

[103] HYAMS 67's mass resolution is 20 MeV. The ω region was excluded.

[104] The ρ' contribution is not taken into account.

[105] ACHASOV 07B reports $[\Gamma(\rho(770) \to \eta\gamma)/\Gamma_{\text{total}}] \times [\text{B}(\rho(770) \to e^+e^-)] = (1.32 \pm 0.14 \pm 0.08) \times 10^{-8}$ which we divide by our best value $\text{B}(\rho(770) \to e^+e^-) = (4.72 \pm 0.05) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.

[106] Solution corresponding to constructive ω-ρ interference.

[107] Using $\text{B}(\rho \to e^+e^-) = (4.67 \pm 0.09) \times 10^{-5}$ and $\text{B}(\eta \to \gamma\gamma) = 39.43 \pm 0.26\%$.

[108] Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma^2_{\text{total}}$.

[109] The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).

[110] Using $\text{B}(\rho \to e^+e^-) = (4.75 \pm 0.10) \times 10^{-5}$ from AKHMETSHIN 02 and $\text{B}(\eta \to 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.

[111] Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution. Constructive ρ-ω interference solution.

[112] Statistical significance is less than 3σ.

[113] Model dependent, assumes $I = 1$, 2, or 3 for the 3π system.

[114] Assuming no interference between the ρ and ω contributions.

[115] Bremsstrahlung from a decay pion and for photon energy above 50 MeV.

[116] Superseded by DOLINSKY 91.

[117] Structure radiation due to quark rearrangement in the decay.

[118] Using $\text{B}(\rho \to e^+e^-) = (4.67 \pm 0.09) \times 10^{-5}$.

[119] Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma^2_{\text{total}}$.

[120] Using $\text{B}(\rho \to e^+e^-) = (4.54 \pm 0.10) \times 10^{-5}$.

[121] Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

[122] This branching ratio includes the conventional VMD mechanism $\rho \to \omega\pi^0$, $\omega \to \pi^0\gamma$, and the new decay mode $\rho \to f_0(600)\gamma$, $f_0(600) \to \pi^0\pi^0$ with a branching ratio $(2.0^{+1.1}_{-0.9} \pm 0.3) \times 10^{-5}$ differing from zero by 2.0 standard deviations.

[123] This branching ratio includes the conventional VMD mechanism $\rho \to \omega\pi^0$, $\omega \to \pi^0\gamma$ and the new decay mode $\rho \to f_0(600)\gamma$, $f_0(600) \to \pi^0\pi^0$ with a branching ratio $(1.9^{+0.9}_{-0.8} \pm 0.4) \times 10^{-5}$ differing from zero by 2.4 standard deviations. Supersedes ACHASOV 00G.

[124] Superseded by ACHASOV 02F.

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