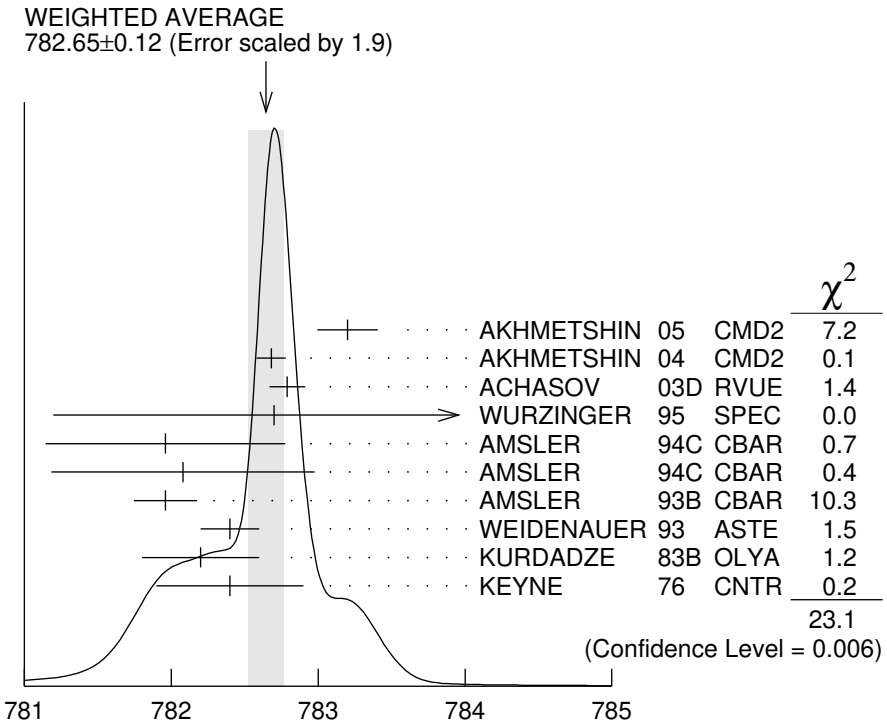
$\omega(782)$

$I^G(J^{PC}) = 0^-(1^{--})$

$\omega(782)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
782.65±0.12 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.			
783.20±0.13±0.16	18680	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
782.68±0.09±0.04	11200	[1] AKHMETSHIN	04	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
782.79±0.08±0.09	1.2M	[2] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$
782.7 ±0.1 ±1.5	19500	WURZINGER	95	SPEC	1.33 $pd \to {}^3\mathrm{He}\omega$
781.96±0.17±0.80	11k	[3] AMSLER	94C	CBAR	0.0 $\overline{p}p \to \omega\eta\pi^0$
782.08±0.36±0.82	3463	[4] AMSLER	94C	CBAR	0.0 $\overline{p}p \to \omega\eta\pi^0$
781.96±0.13±0.17	15k	AMSLER	93B	CBAR	0.0 $\overline{p}p \to \omega\pi^0\pi^0$
782.4 ±0.2	270k	WEIDENAUER	93	ASTE	$\overline{p}p \to 2\pi^+2\pi^-\pi^0$
782.2 ±0.4	1488	KURDADZE	83B	OLYA	$e^+e^- \to \pi^+\pi^-\pi^0$
782.4 ±0.5	7000	[5] KEYNE	76	CNTR	$\pi^- p \to \omega n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
781.78±0.10		[6] BARKOV	87	CMD	$e^+e^- \to \pi^+\pi^-\pi^0$
783.3 ±0.4	433	CORDIER	80	DM1	$e^+e^- \to \pi^+\pi^-\pi^0$
782.5 ±0.8	33260	ROOS	80	RVUE	0.0–3.6 $\overline{p}p$
782.6 ±0.8	3000	BENKHEIRI	79	OMEG	9–12 $\pi^\pm p$
781.8 ±0.6	1430	COOPER	78B	HBC	0.7–0.8 $\overline{p}p \to 5\pi$
782.7 ±0.9	535	VANAPEL...	78	HBC	7.2 $\overline{p}p \to \overline{p}p\omega$
783.5 ±0.8	2100	GESSAROLI	77	HBC	11 $\pi^- p \to \omega n$
782.5 ±0.8	418	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p$
783.4 ±1.0	248	BIZZARRI	71	HBC	0.0 $p\overline{p} \to K^+K^-\omega$
781.0 ±0.6	510	BIZZARRI	71	HBC	0.0 $p\overline{p} \to K_1K_1\omega$
783.7 ±1.0	3583	[7] COYNE	71	HBC	3.7 $\pi^+ p \to p\pi^+\pi^+\pi^-\pi^0$
784.1 ±1.2	750	ABRAMOVI...	70	HBC	3.9 $\pi^- p$
783.2 ±1.6		[8] BIGGS	70B	CNTR	$<$4.1 γ C $\to \pi^+\pi^-$ C
782.4 ±0.5	2400	BIZZARRI	69	HBC	0.0 $\overline{p}p$

[1] Update of AKHMETSHIN 00C.
[2] From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
[3] From the $\eta \to \gamma\gamma$ decay.
[4] From the $\eta \to 3\pi^0$ decay.
[5] Observed by threshold-crossing technique. Mass resolution = 4.8 MeV FWHM.
[6] Systematic uncertainties underestimated.
[7] From best-resolution sample of COYNE 71.
[8] From ω-ρ interference in the $\pi^+\pi^-$ mass spectrum assuming ω width 12.6 MeV.



ω(782) WIDTH

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
8.49±0.08 OUR AVERAGE					
8.68±0.23±0.10	11200	[9] AKHMETSHIN	04	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
8.68±0.04±0.15	1.2M	[10] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$
8.2 ±0.3	19500	WURZINGER	95	SPEC	1.33 $pd \to {}^3\mathrm{He}\omega$
8.4 ±0.1		[11] AULCHENKO	87	ND	$e^+e^- \to \pi^+\pi^-\pi^0$
8.30±0.40		BARKOV	87	CMD	$e^+e^- \to \pi^+\pi^-\pi^0$
9.8 ±0.9	1488	KURDADZE	83B	OLYA	$e^+e^- \to \pi^+\pi^-\pi^0$
9.0 ±0.8	433	CORDIER	80	DM1	$e^+e^- \to \pi^+\pi^-\pi^0$
9.1 ±0.8	451	BENAKSAS	72B	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
12 ±2	1430	COOPER	78B	HBC	0.7–0.8 $\overline{p}p \to 5\pi$
9.4 ±2.5	2100	GESSAROLI	77	HBC	11 $\pi^- p \to \omega n$
10.22±0.43	20000	[12] KEYNE	76	CNTR	$\pi^- p \to \omega n$
13.3 ±2	418	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p$
10.5 ±1.5		BORENSTEIN	72	HBC	2.18 $K^- p$
7.70±0.9 ±1.15	940	BROWN	72	MMS	2.5 $\pi^- p \to n\mathrm{MM}$
10.3 ±1.4	510	BIZZARRI	71	HBC	0.0 $p\overline{p} \to K_1 K_1 \omega$
12.8 ±3.0	248	BIZZARRI	71	HBC	0.0 $p\overline{p} \to K^+K^-\omega$
9.5 ±1.0	3583	COYNE	71	HBC	3.7 $\pi^+ p \to p\pi^+\pi^+\pi^-\pi^0$

[9] Update of AKHMETSHIN 00C.
[10] From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
[11] Relativistic Breit-Wigner includes radiative corrections.
[12] Observed by threshold-crossing technique. Mass resolution = 4.8 MeV FWHM.

$\omega(782)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$\pi^+\pi^-\pi^0$	(89.1 $\pm$0.7) %	S=1.1
Γ_2	$\pi^0\gamma$	($8.90^{+0.27}_{-0.23}$) %	S=1.1
Γ_3	$\pi^+\pi^-$	(1.70$\pm$0.27) %	S=1.4
Γ_4	neutrals (excluding $\pi^0\gamma$)	($1.6\ ^{+7.4}_{-1.1}$) $\times 10^{-3}$	
Γ_5	$\eta\gamma$	(4.9 $\pm$0.5) $\times 10^{-4}$	
Γ_6	$\pi^0 e^+ e^-$	(7.7 $\pm$0.9) $\times 10^{-4}$	S=1.1
Γ_7	$\pi^0\mu^+\mu^-$	(9.6 $\pm$2.3) $\times 10^{-5}$	
Γ_8	$\eta e^+ e^-$		
Γ_9	$e^+ e^-$	(7.18$\pm$0.12) $\times 10^{-5}$	S=1.1
Γ_{10}	$\pi^+\pi^-\pi^0\pi^0$	$<$ 2 %	CL=90%
Γ_{11}	$\pi^+\pi^-\gamma$	$<$ 3.6 $\times 10^{-3}$	CL=95%
Γ_{12}	$\pi^+\pi^-\pi^+\pi^-$	$<$ 1 $\times 10^{-3}$	CL=90%
Γ_{13}	$\pi^0\pi^0\gamma$	(6.7 $\pm$1.1) $\times 10^{-5}$	
Γ_{14}	$\eta\pi^0\gamma$	$<$ 3.3 $\times 10^{-5}$	CL=90%
Γ_{15}	$\mu^+\mu^-$	(9.0 $\pm$3.1) $\times 10^{-5}$	
Γ_{16}	3γ	$<$ 1.9 $\times 10^{-4}$	CL=95%
	Charge conjugation (C) violating modes		
Γ_{17}	$\eta\pi^0$ C	$<$ 1 $\times 10^{-3}$	CL=90%
Γ_{18}	$3\pi^0$ C	$<$ 3 $\times 10^{-4}$	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to 15 branching ratios uses 47 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 33.3$ for 38 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, $x_i \equiv \Gamma_i/\Gamma_{\rm total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	28								
x_3	−36	−10							
x_4	−89	−55	1						
x_5	6	8	−2	−8					
x_6	−1	0	0	0	0				
x_7	0	0	0	0	0	0			
x_9	−44	−53	16	53	−15	1	0		
x_{13}	1	3	0	−2	0	0	0	−2	
x_{15}	0	0	0	0	0	0	0	0	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_9	x_{13}

$\omega(782)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.60 ±0.02 OUR EVALUATION					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.591±0.015	11200	[13,14] AKHMETSHIN	04	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
0.653±0.003±0.021	1.2M	[15] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$
0.600±0.031	10625	DOLINSKY	89	ND	$e^+e^- \to \pi^0\gamma$

[13] Using B($\omega \to \pi^+\pi^-\pi^0$) = 0.891 ± 0.007 and $\Gamma_{\rm total}$ = 8.44 ± 0.09 MeV.
[14] Update of AKHMETSHIN 00C.
[15] Using ACHASOV 03, ACHASOV 03D and B($\omega \to \pi^+\pi^-$) = (1.70 ± 0.28)%.

$\Gamma(\pi^0\gamma)$ Γ_2

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
788±12±27	36500	[16] ACHASOV	03	SND	0.60–0.97 $e^+e^- \to \pi^0\gamma$
764±51	10625	DOLINSKY	89	ND	$e^+e^- \to \pi^0\gamma$

[16] Using Γ_ω = 8.44 ± 0.09 MeV and B($\omega \to \pi^0\gamma$) from ACHASOV 03.

$\Gamma(\eta\gamma)$ Γ_5

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.1 ± 2.5	[17] DOLINSKY	89	ND	$e^+e^- \to \eta\gamma$

[17] Using $\Gamma_\omega = 8.4 \pm 0.1$ MeV and $B(\omega \to \eta\gamma)$ from DOLINSKY 89.

$\omega(782)$ $\Gamma(e^+e^-)\Gamma(i)/\Gamma^2(\text{total})$

$\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_1/\Gamma^2$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
6.39 ± 0.10 OUR FIT Error includes scale factor of 1.1.					
6.38 ± 0.10 OUR AVERAGE Error includes scale factor of 1.1.					
$6.24 \pm 0.11 \pm 0.08$	11200	[18] AKHMETSHIN	04	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
$6.70 \pm 0.06 \pm 0.27$		AUBERT,B	04N	BABR	10.6 $e^+e^- \to \pi^+\pi^-\pi^0\gamma$
$6.74 \pm 0.04 \pm 0.24$	1.2M	[19,20] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$
6.37 ± 0.35		[19] DOLINSKY	89	ND	$e^+e^- \to \pi^+\pi^-\pi^0$
6.45 ± 0.24		[19] BARKOV	87	CMD	$e^+e^- \to \pi^+\pi^-\pi^0$
5.79 ± 0.42	1488	[19] KURDADZE	83B	OLYA	$e^+e^- \to \pi^+\pi^-\pi^0$
5.89 ± 0.54	433	[19] CORDIER	80	DM1	$e^+e^- \to \pi^+\pi^-\pi^0$
7.54 ± 0.84	451	[19] BENAKSAS	72B	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_2/\Gamma^2$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
$6.39^{+0.16}_{-0.14}$ OUR FIT					
6.45 ± 0.17 OUR AVERAGE					
$6.47 \pm 0.14 \pm 0.39$	18680	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
$6.50 \pm 0.11 \pm 0.20$	36500	[21] ACHASOV	03	SND	0.60–0.97 $e^+e^- \to \pi^0\gamma$
$6.34 \pm 0.21 \pm 0.21$	10625	[19] DOLINSKY	89	ND	$e^+e^- \to \pi^0\gamma$

$\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_5/\Gamma^2$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID		TECN	COMMENT
3.51 ± 0.35 OUR FIT					
3.3 ± 0.4 OUR AVERAGE					
$3.17^{+1.85}_{-1.31} \pm 0.21$	17400	[22] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
$3.41 \pm 0.52 \pm 0.21$	23k	[23,24] AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
$3.25 \pm 0.51 \pm 0.10$	312	[25] ACHASOV	00D	SND	$e^+e^- \to \eta\gamma$

$\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_3/\Gamma^2$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$1.247 \pm 0.062 \pm 0.042$	4.5M	[26] ACHASOV	05A	SND	$e^+e^- \to \pi^+\pi^-$

[18] Update of AKHMETSHIN 00C.
[19] Recalculated by us from the cross section in the peak.
[20] From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
[21] Using $\sigma_{\phi\to\pi^0\gamma}$ from ACHASOV 00 and m_ω= 782.57 MeV in the model with the energy-independent phase of ρ-ω interference equal to $(-10.2\pm7.0)^\circ$.
[22] From the $\eta\to 2\gamma$ decay and using B($\eta\to\gamma\gamma$)= 39.43 ± 0.26%.
[23] From the $\eta\to 3\pi^0$ decay and using B($\eta\to 3\pi^0$)= $(32.24\pm0.29)\times10^{-2}$.
[24] 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).
[25] From the $\eta\to 3\pi^0$ decay and using B($\eta\to 3\pi^0$) = $(32.2\pm0.4)\times10^{-2}$.
[26] 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. Using $\omega(782)$ mass and width from ACHASOV 03D.

ω(782) BRANCHING RATIOS

Γ(neutrals)/Γ(π⁺π⁻π⁰) (Γ2+Γ4)/Γ1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.102±0.008 OUR FIT					
0.103 $^{+0.011}_{-0.010}$ OUR AVERAGE					
0.15 ±0.04	46	AGUILAR-...	72B	HBC	3.9,4.6 K^-p
0.10 ±0.03	19	BARASH	67B	HBC	0.0 $\overline{p}p$
0.134±0.026	850	DIGIUGNO	66B	CNTR	1.4 π^-p
0.097±0.016	348	FLATTE	66	HBC	1.4 – 1.7 $K^-p\to$ ΛMM
0.06 $^{+0.05}_{-0.02}$		JAMES	66	HBC	2.1 π^+p
0.08 ±0.03	35	KRAEMER	64	DBC	1.2 π^+d
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.11 ±0.02	20	BUSCHBECK	63	HBC	1.5 K^-p

Γ(π⁺π⁻)/Γ(π⁺π⁻π⁰) Γ3/Γ1

See also $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$.

VALUE	DOCUMENT ID		TECN	COMMENT
0.0191±0.0030 OUR FIT Error includes scale factor of 1.4.				
0.026 ±0.005 OUR AVERAGE				
0.021 $^{+0.028}_{-0.009}$	[28] RATCLIFF	72	ASPK	15 $\pi^-p\to n2\pi$
0.028 ±0.006	BEHREND	71	ASPK	Photoproduction
0.022 $^{+0.009}_{-0.01}$	[29] ROOS	70	RVUE	

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.0999^{+0.0029}_{-0.0025}$ OUR FIT Error includes scale factor of 1.1.					
0.097 ±0.005 OUR AVERAGE					
0.0994 ± 0.0036 ± 0.0038		[30] AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$, $\pi^0\pi^0\gamma$
0.084 ±0.013		KEYNE	76	CNTR	$\pi^- p \to \omega n$
0.109 ±0.025		BENAKSAS	72C	OSPK	$e^+e^- \to \pi^0\gamma$
0.081 ±0.020		BALDIN	71	HLBC	2.9 $\pi^+ p$
0.13 ±0.04		JACQUET	69B	HLBC	2.05 $\pi^+ p \to \pi^+ p\omega$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.097 ±0.002 ±0.005	1.2M	[31,32] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$
0.099 ±0.007		[31] DOLINSKY	89	ND	$e^+e^- \to \pi^0\gamma$

$\Gamma(\pi^+\pi^-\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{11}/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.066	90	KALBFLEISCH	75	HBC	2.18 $K^- p \to \Lambda\pi^+\pi^-\gamma$
<0.05	90	FLATTE	66	HBC	1.2 – 1.7 $K^- p \to \Lambda\pi^+\pi^-\gamma$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0036	95	WEIDENAUER	90	ASTE	$p\overline{p} \to \pi^+\pi^-\pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.004	95	BITYUKOV	88B	SPEC	32 $\pi^- p \to \pi^+\pi^-\gamma X$

$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1\times10^{-3}$	90	KURDADZE	88	OLYA	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-$

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

VALUE (units 10^{-2})	CL%	DOCUMENT ID		TECN	COMMENT
<2	90	KURDADZE	86	OLYA	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$

$\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{15}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<0.2	90	WILSON	69	OSPK	12 π^- C → Fe
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.7	74	FLATTE	66	HBC	1.2 – 1.7 $K^- p \to \Lambda\mu^+\mu^-$
<1.2		BARBARO-...	65	HBC	2.7 $K^- p$

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
6.7±1.1 OUR FIT					
6.5±1.2 OUR AVERAGE					
$6.4^{+2.4}_{-2.0}\pm0.8$	190	[33] AKHMETSHIN	04B	CMD2	0.6–0.97 $e^+e^- \to \pi^0\pi^0\gamma$
$6.6^{+1.4}_{-1.3}\pm0.6$	295	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. • • •					
$11.8^{+2.1}_{-1.9}\pm1.4$	190	[34] AKHMETSHIN	04B	CMD2	0.6–0.97 $e^+e^- \to \pi^0\pi^0\gamma$
$7.8\pm2.7\pm2.0$	63	[33,35] ACHASOV	00G	SND	$e^+e^- \to \pi^0\pi^0\gamma$
$12.7\pm2.3\pm2.5$	63	[34,35] ACHASOV	00G	SND	$e^+e^- \to \pi^0\pi^0\gamma$

$\Gamma(\pi^0\pi^0\gamma)/\Gamma(\pi^0\gamma)$ Γ_{13}/Γ_2

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
(7.6 ±1.3) × 10^{-4} OUR FIT						
0.00085±0.00029		40 ± 14	ALDE	94B	GAM2	$38\pi^- p \to \pi^0\pi^0\gamma n$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 0.005	90		DOLINSKY	89	ND	$e^+e^- \to \pi^0\pi^0\gamma$
< 0.18	95		KEYNE	76	CNTR	$\pi^- p \to \omega n$
< 0.15	90		BENAKSAS	72C	OSPK	e^+e^-
< 0.14			BALDIN	71	HLBC	2.9 $\pi^+ p$
< 0.1	90		BARMIN	64	HLBC	1.3–2.8 $\pi^- p$

$\Gamma(\eta\pi^0)/\Gamma_{total}$ Γ_{17}/Γ

Violates C conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.001	90	ALDE	94B	GAM2	$38\pi^- p \to \eta\pi^0 n$

$\Gamma(\eta\pi^0\gamma)/\Gamma_{total}$ Γ_{14}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<3.3	90	AKHMETSHIN	04B	CMD2	0.6–0.97 $e^+e^- \to \eta\pi^0\gamma$

$[\Gamma(\eta\gamma)+\Gamma(\eta\pi^0)]/\Gamma(\pi^+\pi^-\pi^0)$ $(\Gamma_5+\Gamma_{17})/\Gamma_1$

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.016	90	[36] FLATTE	66	HBC	1.2 – 1.7 $K^- p \to \Lambda\pi^+\pi^-$ MM
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.045	95	JACQUET	69B	HLBC	2.05 $\pi^+ p \to \pi^+ p\omega$

$\Gamma(\text{neutrals})/\Gamma(\text{charged particles})$ $(\Gamma_2+\Gamma_4)/(\Gamma_1+\Gamma_3)$

VALUE	DOCUMENT ID		TECN	COMMENT
0.100±0.008 OUR FIT				
0.124±0.021	FELDMAN	67C	OSPK	1.2 $\pi^- p$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.00045	90	DOLINSKY	89	ND	$e^+e^- \to \pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.08	95	JACQUET	69B	HLBC	2.05 $\pi^+ p \to \pi^+ p\omega$

$\Gamma(\eta\gamma)/\Gamma(\pi^0\gamma)$ Γ_5/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0098 ± 0.0024	[37] ALDE	93	GAM2	38$\pi^- p \to \omega n$
0.0082 ± 0.0033	[38] DOLINSKY	89	ND	$e^+e^- \to \eta\gamma$
0.010 ± 0.045	APEL	72B	OSPK	4–8 $\pi^- p \to n3\gamma$

$\Gamma(\pi^0\mu^+\mu^-)/\Gamma_{total}$ Γ_7/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
0.96 ± 0.23 OUR FIT				
0.96 ± 0.23	DZHELYADIN	81B	CNTR	25–33 $\pi^- p \to \omega n$

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{total}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
7.7 ± 0.9 OUR FIT Error includes scale factor of 1.1.					
7.7 ± 0.9 OUR AVERAGE Error includes scale factor of 1.1.					
8.19 ± 0.71 ± 0.62		AKHMETSHIN	05A	CMD2	0.72-0.84 e^+e^-
5.9 ± 1.9	43	DOLINSKY	88	ND	$e^+e^- \to \pi^0 e^+e^-$

$\Gamma(\eta e^+ e^-)/\Gamma_{total}$ Γ_8/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.1	AKHMETSHIN	05A	CMD2	0.72-0.84 e^+e^-

$\Gamma(e^+e^-)/\Gamma_{total}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
0.718 ± 0.012 OUR FIT Error includes scale factor of 1.1.					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.700 ± 0.016	11200	[39,40] AKHMETSHIN	04	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
0.752 ± 0.004 ± 0.024	1.2M	[39,41] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$
0.714 ± 0.036		[39] DOLINSKY	89	ND	$e^+e^- \to \pi^+\pi^-\pi^0$
0.72 ± 0.03		[39] BARKOV	87	CMD	$e^+e^- \to \pi^+\pi^-\pi^0$
0.64 ± 0.04	1488	[39] KURDADZE	83B	OLYA	$e^+e^- \to \pi^+\pi^-\pi^0$
0.675 ± 0.069	433	[39] CORDIER	80	DM1	$e^+e^- \to \pi^+\pi^-\pi^0$
0.83 ± 0.10	451	[39] BENAKSAS	72B	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$
0.77 ± 0.06		[42] AUGUSTIN	69D	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$
0.65 ± 0.13	33	[43] ASTVACAT...	68	OSPK	Assume SU(3)+mixing

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
9.0 ± 3.1 OUR FIT					
9.0 ± 2.9 ± 1.1	18	HEISTER	02C	ALEP	$Z \to \mu^+\mu^- + X$

$\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(\Gamma_2+\Gamma_4)/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.091±0.006 OUR FIT					
0.081±0.011 OUR AVERAGE					
0.075±0.025		BIZZARRI	71	HBC	0.0 $p\overline{p}$
0.079±0.019		DEINET	69B	OSPK	1.5 $\pi^- p$
0.084±0.015		BOLLINI	68C	CNTR	2.1 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.073±0.018	42	BASILE	72B	CNTR	1.67 $\pi^- p$

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_3/Γ

See also $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.70±0.27 OUR FIT Error includes scale factor of 1.4.					
1.57±0.24 OUR AVERAGE Error includes scale factor of 1.2.					
1.30±0.24±0.05	11200	[44] AKHMETSHIN	04	CMD2	$e^+e^- \to \pi^+\pi^-$
$2.38^{+1.77}_{-0.90}\pm0.18$	5.4k	[45] ACHASOV	02E	SND	1.1–1.38 $e^+e^- \to \pi^+\pi^-\pi^0$
2.3 ±0.5		BARKOV	85	OLYA	$e^+e^- \to \pi^+\pi^-$
$1.6\ ^{+0.9}_{-0.7}$		QUENZER	78	DM1	$e^+e^- \to \pi^+\pi^-$
3.6 ±1.9		BENAKSAS	72	OSPK	$e^+e^- \to \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.75±0.11	4.5M	[46] ACHASOV	05A	SND	$e^+e^- \to \pi^+\pi^-$
2.01±0.29		[47] BENAYOUN	03	RVUE	$e^+e^- \to \pi^+\pi^-$
1.9 ±0.3		[48] GARDNER	99	RVUE	$e^+e^- \to \pi^+\pi^-$
2.3 ±0.4		[49] BENAYOUN	98	RVUE	$e^+e^- \to \pi^+\pi^-, \mu^+\mu^-$
1.0 ±0.11		[50] WICKLUND	78	ASPK	3,4,6 $\pi^\pm N$
1.22±0.30		ALVENSLEB...	71C	CNTR	Photoproduction
$1.3\ ^{+1.2}_{-0.9}$		MOFFEIT	71	HBC	2.8,4.7 γp
$0.80^{+0.28}_{-0.20}$		[51] BIGGS	70B	CNTR	4.2γ C $\to \pi^+\pi^-$ C

$\Gamma(\pi^+\pi^-)/\Gamma(\pi^0\gamma)$ Γ_3/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.20±0.04	1.98M	[52] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma(\pi^0\pi^0\gamma)/\Gamma(\text{neutrals})$ $\Gamma_{13}/(\Gamma_2+\Gamma_4)$

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.22±0.07		[27] DAKIN	72	OSPK	1.4 $\pi^- p \to n$MM
<0.19	90	DEINET	69B	OSPK	

[27] See $\Gamma(\pi^0\gamma)/\Gamma(\text{neutrals})$.

$\Gamma(\pi^0\gamma)/\Gamma(\text{neutrals})$ $\Gamma_2/(\Gamma_2+\Gamma_4)$

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.78±0.07		[53] DAKIN	72	OSPK	1.4 $\pi^- p \to n$MM
>0.81	90	DEINET	69B	OSPK	

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
4.9 ±0.5 OUR FIT					
6.3 ±1.3 OUR AVERAGE Error includes scale factor of 1.2.					
6.6 ±1.7		[54] ABELE	97E	CBAR	0.0 $\overline{p}p \to 5\gamma$
8.3 ±2.1		ALDE	93	GAM2	38 $\pi^- p \to \omega n$
$3.0\ ^{+2.5}_{-1.8}$		[55] ANDREWS	77	CNTR	6.7–10 γ Cu
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$4.44^{+2.59}_{-1.83}\pm0.28$	17400	[56,57] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
5.10±0.72±0.34	23k	[58] AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
4.60±0.72±0.19	312	[56,59] ACHASOV	00D	SND	$e^+e^- \to \eta\gamma$
0.7 to 5.5		[60] CASE	00	CBAR	0.0 $p\overline{p} \to \eta\eta\gamma$
$6.56^{+2.41}_{-2.55}$	3525	[55,61] BENAYOUN	96	RVUE	$e^+e^- \to \eta\gamma$
7.3 ±2.9		[55,56] DOLINSKY	89	ND	$e^+e^- \to \eta\gamma$

$\Gamma(\pi^0\mu^+\mu^-)/\Gamma(\mu^+\mu^-)$ Γ_7/Γ_{15}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.2±0.6	30	[62] DZHELYADIN	79	CNTR	25–33 $\pi^- p$

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.8965±0.0016±0.0048	1.2M	[39,41] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$
0.880 ±0.020 ±0.032	11200	[39,63] AKHMETSHIN	00C	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
0.8942±0.0062		[39] DOLINSKY	89	ND	$e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma(3\pi^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

Violates C conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0003	90	PROKOSHKIN	95	GAM2	38 $\pi^- p \to 3\pi^0 n$

$\Gamma(3\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{18}/Γ_1

Violates C conservation.

VALUE	CL%	DOCUMENT ID		COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.009	90	BARBERIS	01	450 $pp \to p_f 3\pi^0 p_s$

$\Gamma(3\gamma)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<1.9	95	[64] ABELE	97E	CBAR	0.0 $\overline{p}p \to 5\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2	90	[64] PROKOSHKIN	95	GAM2	38 $\pi^- p \to 3\gamma n$

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$9.06\pm0.20\pm0.57$	18680	[31,65] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
$9.34\pm0.15\pm0.31$	36500	[31] ACHASOV	03	SND	0.60–0.97 $e^+e^- \to \pi^0\gamma$
$8.65\pm0.16\pm0.42$	1.2M	[39,41] ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \to \pi^+\pi^-\pi^0$
8.39 ± 0.24	9975	[66] BENAYOUN	96	RVUE	$e^+e^- \to \pi^0\gamma$
8.88 ± 0.62	10625	[31] DOLINSKY	89	ND	$e^+e^- \to \pi^0\gamma$

[28] Significant interference effect observed. NB of $\omega \to 3\pi$ comes from an extrapolation.
[29] ROOS 70 combines ABRAMOVICH 70 and BIZZARRI 70.
[30] From $\sigma_0^{\omega\pi^0 \to \pi^0\pi^0\gamma}(m_\phi)/\sigma_0^{\omega\pi^0 \to \pi^+\pi^-\pi^0\pi^0}(m_\phi)$ with a phase-space correction factor of 1/1.023.
[31] Not independent of the corresponding $\Gamma(e^+e^-)\times\Gamma(\pi^0\gamma)/\Gamma^2_{\text{total}}$.
[32] Using ACHASOV 03.
[33] In the model assuming the $\rho \to \pi^0\pi^0\gamma$ decay via the $\omega\pi$ and $f_0(600)\gamma$ mechanisms.
[34] In the model assuming the $\rho \to \pi^0\pi^0\gamma$ decay via the $\omega\pi$ mechanism only.
[35] Superseded by ACHASOV 02F.
[36] Restated by us using B($\eta \to$ charged modes) = 29.2%.
[37] Model independent determination.
[38] Solution corresponding to constructive ω-ρ interference.
[39] Not independent of the corresponding $\Gamma(e^+e^-)\times\Gamma(\pi^+\pi^-\pi^0)/\Gamma^2_{\text{total}}$.
[40] Using B($\omega \to \pi^+\pi^-\pi^0$) = 0.891 ± 0.007. Update of AKHMETSHIN 00C.
[41] Using ACHASOV 03, ACHASOV 03D and B($\omega \to \pi^+\pi^-$) = (1.70 ± 0.28)%.
[42] Rescaled by us to correspond to ω width 8.4 MeV. Systematic errors underestimated.
[43] Not resolved from ρ decay. Error statistical only.
[44] Update of AKHMETSHIN 02.
[45] From the $m_{\pi^+\pi^-}$ spectrum taking into account the interference of the $\rho\pi$ and $\omega\pi$ amplitudes.
[46] Using $\Gamma(\omega \to e^+e^-)$ from the 2004 Edition of this Review (PDG 04).
[47] Using the data of AKHMETSHIN 02 in the hidden local symmetry model.
[48] Using the data of BARKOV 85.
[49] Using the data of BARKOV 85 in the hidden local symmetry model.
[50] From a model-dependent analysis assuming complete coherence.
[51] Re-evaluated under $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ by BEHREND 71 using more accurate $\omega \to \rho$ photoproduction cross-section ratio.
[52] Using the data of ALOISIO 02D.
[53] Error statistical only. Authors obtain good fit also assuming $\pi^0\gamma$ as the only neutral decay.
[54] No flat $\eta\eta\gamma$ background assumed.
[55] Solution corresponding to constructive ω-ρ interference.
[56] Not independent of the corresponding $\Gamma(e^+e^-)\times\Gamma(\eta\gamma)/\Gamma^2_{\text{total}}$.
[57] Using B($\omega \to e^+e^-$) = (7.14 ± 0.13) × 10^{-5} and B($\eta \to \gamma\gamma$) = 39.43 ± 0.26%.
[58] Using B($\omega \to e^+e^-$)= (7.07 ± 0.19) × 10^{-5} and using B($\eta \to 3\pi^0$)= (32.24 ± 0.29) × 10^{-2}. Solution corresponding to constructive ω-ρ interference. 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). Not independent of the corresponding $\Gamma(e^+e^-)\times\Gamma(\eta\gamma)/\Gamma^2_{\text{total}}$.

[59] Using B($\omega \to e^+e^-$) = (7.07 ± 0.19) × 10^{-5} and B($\eta \to 3\pi^0$) = (32.2 ± 0.4) × 10^{-2}.
[60] Depending on the degree of coherence with the flat $\eta\eta\gamma$ background and using B($\omega \to \pi^0\gamma$)=(8.5 ± 0.5) × 10^{-2}.
[61] Reanalysis of DRUZHININ 84, DOLINSKY 89, DOLINSKY 91 taking into account the triangle anomaly contributions.
[62] Superseded by DZHELYADIN 81B result above.
[63] Using Γ(e^+e^-)=0.60 ± 0.02 keV.
[64] From direct 3γ decay search.
[65] Using B($\omega \to e^+e^-$)= (7.14 ± 0.13) × 10^{-5}.
[66] Reanalysis of DRUZHININ 84, DOLINSKY 89, DOLINSKY 91 taking into account the triangle anomaly contributions.

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