$\phi(1020)$

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

ϕ(1020) MASS

VALUE (MeV)			EVTS	DOCUMENT ID		TECN	COMMENT
1019.460	**±0.016**	**OUR AVERAGE**					
1019.443	±0.010	±0.060	1.28M	[1] ACHASOV	24	SND	$e^+e^- \to K^0_L K^0_S$
1019.463	±0.061		2.3M	[2] KOZYREV	18	CMD3	$e^+e^- \to K^+K^-$, $K^0_S K^0_L$
1019.462	±0.042	±0.056	28k	[3] LEES	14H	BABR	$e^+e^- \to K^0_S K^0_L \gamma$
1019.51	±0.02	±0.05		[4] LEES	13Q	BABR	$e^+e^- \to K^+K^-\gamma$
1019.30	±0.02	±0.10	105k	AKHMETSHIN	06	CMD2	0.98–1.06 $e^+e^- \to \pi^+\pi^-\pi^0$
1019.52	±0.05	±0.05	17.4k	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
1019.483	±0.011	±0.025	272k	[5] AKHMETSHIN	04	CMD2	$e^+e^- \to K^0_L K^0_S$
1019.42	±0.05		1900k	[6] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
1019.40	±0.04	±0.05	23k	AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
1019.36	±0.12			[7] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$
1019.38	±0.07	±0.08	2200	[8] AKHMETSHIN	99F	CMD2	$e^+e^- \to \pi^+\pi^- \geq 2\gamma$
1019.51	±0.07	±0.10	11169	AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
1019.5	±0.4			BARBERIS	98	OMEG	450 $pp \to pp2K^+2K^-$
1019.42	±0.06		55600	AKHMETSHIN	95	CMD2	$e^+e^- \to$ hadrons
1019.7	±0.3		2012	DAVENPORT	86	MPSF	400 $pA \to 4KX$
1019.7	±0.1	±0.1	5079	ALBRECHT	85D	ARG	10 $e^+e^- \to K^+K^-X$
1019.3	±0.1		1500	ARENTON	82	AEMS	11.8 polar. $pp \to KK$
1019.67	±0.17		25080	[9] PELLINEN	82	RVUE	
1019.52	±0.13		3681	BUKIN	78C	OLYA	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •							
1019.0330	±0.0084			[10] DUBNICKA	24	RVUE	$e^+e^- \to K^+K^-$, $K^0_S K^0_L$
1019.761	±0.130		34M	[11] IGNATOV	24	CMD3	$e^+e^- \to \pi^+\pi^-$
1018.4	±0.5	±0.1		[12] ALBRECHT	20	CBAR	0.9 $\overline{p}p \to K^+K^-\pi^0$
1019.21	±0.04	±0.03		[13] HOID	20	RVUE	$e^+e^- \to \pi^0\gamma$
1019.54	±0.10	±0.51		[14] AAIJ	19H	LHCB	$pp \to D^\pm X$
1019.20	±0.02	±0.01		[15] HOFERICHT...	19	RVUE	$e^+e^- \to \pi^+\pi^-\pi^0$
1019.469	±0.061		1.7M	KOZYREV	18	CMD3	$e^+e^- \to K^+K^-$
1019.457	±0.061		610k	KOZYREV	16	CMD3	$e^+e^- \to K^0_S K^0_L$
1019.48	±0.01			LEES	13F	BABR	$D^+ \to K^+K^-\pi^+$
1019.441	±0.008	±0.080	542k	[16] AKHMETSHIN	08	CMD2	1.02 $e^+e^- \to K^+K^-$

1019.63	±0.07		12540	[17] AUBERT,B	05J	BABR	$D^0 \to \overline{K}^0 K^+ K^-$
1019.8	±0.7			ARMSTRONG	86	OMEG	85 $\pi^+ / p p \to \pi^+ / p 4K p$
1020.1	±0.11		5526	[17] ATKINSON	86	OMEG	20–70 γp
1019.7	±1.0			BEBEK	86	CLEO	$e^+ e^- \to \Upsilon(4S)$
1019.411	±0.008		642k	[18] DIJKSTRA	86	SPEC	100–200 $\pi^\pm$, $\overline{p}$, p, $K^\pm$, on Be
1020.9	±0.2			[17] FRAME	86	OMEG	13 $K^+ p \to \phi K^+ p$
1021.0	±0.2			[17] ARMSTRONG	83B	OMEG	18.5 $K^- p \to K^- K^+ \Lambda$
1020.0	±0.5			[17] ARMSTRONG	83B	OMEG	18.5 $K^- p \to K^- K^+ \Lambda$
1019.7	±0.3			[17] BARATE	83	GOLI	190 π^- Be $\to 2\mu$X
1019.8	±0.2	±0.5	766	IVANOV	81	OLYA	1–1.4 $e^+ e^- \to K^+ K^-$
1019.4	±0.5		337	COOPER	78B	HBC	0.7–0.8 $\overline{p} p \to K^0_S K^0_L \pi^+ \pi^-$
1020	±1		383	[17] BALDI	77	CNTR	10 $\pi^- p \to \pi^- \phi p$
1018.9	±0.6		800	COHEN	77	ASPK	6 $\pi^\pm N \to K^+ K^- N$
1019.7	±0.5		454	KALBFLEISCH	76	HBC	2.18 $K^- p \to \Lambda K \overline{K}$
1019.4	±0.8		984	BESCH	74	CNTR	2 $\gamma p \to p K^+ K^-$
1020.3	±0.4		100	BALLAM	73	HBC	2.8–9.3 γp
1019.4	±0.7			BINNIE	73B	CNTR	$\pi^- p \to \phi n$
1019.6	±0.5		120	[19] AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \to \Lambda K^+ K^-$
1019.9	±0.5		100	[19] AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \to K^- p K^+ K^-$
1020.4	±0.5		131	COLLEY	72	HBC	10 $K^+ p \to K^+ p \phi$
1019.9	±0.3		410	STOTTLE...	71	HBC	2.9 $K^- p \to \Sigma / \Lambda K \overline{K}$

[1] From a fit of the cross section in the energy region $1.000 < \sqrt{s} < 1.100$ GeV using a vector meson dominance model with contribution from $\phi(1020)$, $\rho(770)$, $\omega(782)$ and higher vector resonances. The the first three points near the threshold are removed in the fit.

[2] Average of KOZYREV 16 and KOZYREV 18 values taking into account the correlated uncertainties. Supersedes individual KOZYREV 16 and KOZYREV 18 results.

[3] Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$.

[4] Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations.

[5] Update of AKHMETSHIN 99D

[6] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of $K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

[7] Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included.

[8] Using a total width of 4.43 ± 0.05 MeV.

[9] PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DEGROOT 74.

[10] From the fit to data of CMD3, BABAR and BES3.

[11] From a fit of the pion form factor in the energy range 0.32 < $\sqrt{s}$ < 1.2 GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. Systematic errors not estimated.
[12] Width fixed at 4.2 MeV.
[13] The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization. Inclusion of vacuum polarization gives 1019.457 ± 0.020 MeV.
[14] From the $D^\pm \to K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUDE 18.
[15] The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization.
[16] Strongly correlated with AKHMETSHIN 04.
[17] Systematic errors not evaluated.
[18] Weighted and scaled average of 12 measurements of DIJKSTRA 86.
[19] Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

$\phi(1020)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
4.249±0.013 OUR AVERAGE		Error includes scale factor of 1.1.			
4.212±0.20 ±0.13	1.28M	[1] ACHASOV	24	SND	$e^+e^- \to K^0_L K^0_S$
4.245±0.013	2.3M	[2] KOZYREV	18	CMD3	$e^+e^- \to K^+K^-$, $K^0_S K^0_L$
4.205±0.103±0.067	28k	[3] LEES	14H	BABR	$e^+e^- \to K^0_S K^0_L \gamma$
4.29 ±0.04 ±0.07		[4] LEES	13Q	BABR	$e^+e^- \to K^+K^-\gamma$
4.30 ±0.06 ±0.17	105k	AKHMETSHIN	06	CMD2	0.98–1.06 $e^+e^- \to \pi^+\pi^-\pi^0$
4.280±0.033±0.025	272k	[5] AKHMETSHIN	04	CMD2	$e^+e^- \to K^0_L K^0_S$
4.21 ±0.04	1900k	[6] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
4.44 ±0.09	55600	AKHMETSHIN	95	CMD2	$e^+e^- \to$ hadrons
4.5 ±0.7	1500	ARENTON	82	AEMS	11.8 polar. $pp \to KK$
4.2 ±0.6	766	[7] IVANOV	81	OLYA	1–1.4 $e^+e^- \to K^+K^-$
4.3 ±0.6		[7] CORDIER	80	DM1	$e^+e^- \to \pi^+\pi^-\pi^0$
4.36 ±0.29	3681	[7] BUKIN	78C	OLYA	$e^+e^- \to$ hadrons
4.4 ±0.6	984	[7] BESCH	74	CNTR	2 $\gamma p \to pK^+K^-$
4.67 ±0.72	681	[7] BALAKIN	71	OSPK	$e^+e^- \to$ hadrons
4.09 ±0.29		BIZOT	70	OSPK	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.151±0.018		[8] DUBNICKA	24	RVUE	$e^+e^- \to K^+K^-$, $K^0_S K^0_L$
4.681±0.277	34M	[9] IGNATOV	24	CMD3	$e^+e^- \to \pi^+\pi^-$
4.07 ±0.13 ±0.01		[10] HOID	20	RVUE	$e^+e^- \to \pi^0\gamma$
4.23 ±0.04 ±0.02		[11] HOFERICHT...	19	RVUE	$e^+e^- \to \pi^+\pi^-\pi^0$
4.249±0.015	1.7M	KOZYREV	18	CMD3	$e^+e^- \to K^+K^-$
4.240±0.017	610k	KOZYREV	16	CMD3	$e^+e^- \to K^0_S K^0_L$
4.37 ±0.02		LEES	13F	BABR	$D^+ \to K^+K^-\pi^+$
4.24 ±0.02 ±0.03	542k	[12] AKHMETSHIN	08	CMD2	1.02 $e^+e^- \to K^+K^-$
4.28 ±0.13	12540	[13] AUBERT,B	05J	BABR	$D^0 \to \overline{K}^0 K^+K^-$

4.45	±0.06	271k		DIJKSTRA	86	SPEC	100 π^- Be
3.6	±0.8	337	[7]	COOPER	78B	HBC	0.7–0.8 $\overline{p}p \to K^0_S K^0_L \pi^+\pi^-$
4.5	±0.50	1300	[7,13]	AKERLOF	77	SPEC	400 pA $\to K^+K^-$X
4.5	±0.8	500	[7,13]	AYRES	74	ASPK	3–6 $\pi^- p \to K^+K^- n$, $K^- p \to K^+K^- \Lambda/\Sigma^0$
3.81	±0.37			COSME	74B	OSPK	$e^+e^- \to K^0_L K^0_S$
3.8	±0.7	454	[7]	BORENSTEIN	72	HBC	2.18 $K^- p \to K\overline{K}n$

[1] From a fit of the cross section in the energy region 1.000 < $\sqrt{s}$ < 1.100 GeV using a vector meson dominance model with contribution from $\phi(1020)$, $\rho(770)$, $\omega(782)$ and higher vector resonances. The the first three points near the threshold are removed in the fit.

[2] Average of KOZYREV 16 and KOZYREV 18 values taking into account the correlated uncertainties. Supersedes individual KOZYREV 16 and KOZYREV 18 results.

[3] Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$.

[4] Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations.

[5] Update of AKHMETSHIN 99D

[6] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^-, $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

[7] Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

[8] From the fit to data of CMD3, BABAR and BES3.

[9] From a fit of the pion form factor in the energy range 0.32 < $\sqrt{s}$ < 1.2 GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. Systematic errors not estimated.

[10] The values were extracted from a dispersively improved Breit-Wigner parameterization.

[11] The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization.

[12] Strongly correlated with AKHMETSHIN 04.

[13] Systematic errors not evaluated.

ϕ(1020) DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	K^+K^-	(49.9 ±0.5) %	S=1.5
Γ_2	$K^0_L K^0_S$	(33.6 ±0.4) %	S=1.3
Γ_3	$\rho\pi + \pi^+\pi^-\pi^0$	(14.9 ±0.4) %	S=1.3
Γ_4	$\pi^+\pi^-\pi^0$		
Γ_5	$\eta\gamma$	(1.306±0.024) %	S=1.2
Γ_6	$\pi^0\gamma$	(1.33 ±0.05) $\times 10^{-3}$	
Γ_7	$\ell^+\ell^-$	—	
Γ_8	e^+e^-	(2.964±0.033) $\times 10^{-4}$	S=1.4
Γ_9	$\mu^+\mu^-$	(2.86 ±0.22) $\times 10^{-4}$	S=1.2
Γ_{10}	ηe^+e^-	(1.08 ±0.04) $\times 10^{-4}$	
Γ_{11}	$\pi^+\pi^-$	(9.5 ±1.9) $\times 10^{-5}$	S=2.0

Γ_{12}	$\omega\pi^0$			$(4.7 \pm 0.5) \times 10^{-5}$	
Γ_{13}	$\omega\gamma$		<	5 %	CL=84%
Γ_{14}	$\rho\gamma$		<	1.2×10^{-5}	CL=90%
Γ_{15}	$\pi^+\pi^-\gamma$			$(4.1 \pm 1.3) \times 10^{-5}$	
Γ_{16}	$f_0(980)\gamma$			$(3.22 \pm 0.19) \times 10^{-4}$	S=1.1
Γ_{17}	$\pi^0\pi^0\gamma$			$(1.13 \pm 0.06) \times 10^{-4}$	
Γ_{18}	$\pi^+\pi^-\pi^+\pi^-$			$(3.9 {}^{+2.8}_{-2.2}) \times 10^{-6}$	
Γ_{19}	$\pi^+\pi^+\pi^-\pi^-\pi^0$		<	4.6×10^{-6}	CL=90%
Γ_{20}	$\pi^0 e^+ e^-$			$(1.33 {}^{+0.07}_{-0.10}) \times 10^{-5}$	
Γ_{21}	$\pi^0\eta\gamma$			$(7.27 \pm 0.30) \times 10^{-5}$	S=1.5
Γ_{22}	$a_0(980)\gamma$			$(7.6 \pm 0.6) \times 10^{-5}$	
Γ_{23}	$K^0\overline{K}^0\gamma$		<	1.9×10^{-8}	CL=90%
Γ_{24}	$\eta'(958)\gamma$			$(6.23 \pm 0.21) \times 10^{-5}$	
Γ_{25}	$\eta\pi^0\pi^0\gamma$		<	2×10^{-5}	CL=90%
Γ_{26}	$\mu^+\mu^-\gamma$			$(1.4 \pm 0.5) \times 10^{-5}$	
Γ_{27}	$\rho\gamma\gamma$		<	1.2×10^{-4}	CL=90%
Γ_{28}	$\eta\pi^+\pi^-$		<	1.8×10^{-5}	CL=90%
Γ_{29}	$\eta\mu^+\mu^-$		<	9.4×10^{-6}	CL=90%
Γ_{30}	$\eta U \to \eta e^+ e^-$		<	1×10^{-6}	CL=90%
Γ_{31}	invisible		<	1.7×10^{-4}	CL=90%
	Lepton Family number (*LF*) violating modes				
Γ_{32}	$e^{\pm}\mu^{\mp}$	*LF*	<	2×10^{-6}	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to 30 branching ratios uses 83 measurements and one constraint to determine 14 parameters. The overall fit has a $\chi^2 = 89.3$ for 70 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle \delta x_i \delta x_j \right\rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	−74									
x_3	−67	0								
x_5	−26	27	3							
x_6	−15	17	2	8						
x_8	64	−77	−9	−36	−22					
x_9	−6	7	1	3	2	−9				
x_{11}	−4	4	0	2	1	−6	1			
x_{12}	−5	6	1	3	2	−8	1	0		
x_{16}	0	0	0	0	0	0	0	0	0	
x_{17}	−13	15	2	18	4	−19	2	1	2	0
x_{18}	−1	1	0	1	0	−2	0	0	0	0
x_{22}	0	0	0	0	0	0	0	0	0	0
x_{24}	−8	9	1	32	3	−12	1	1	1	0
	x_1	x_2	x_3	x_5	x_6	x_8	x_9	x_{11}	x_{12}	x_{16}

x_{18}	0		
x_{22}	0	0	
x_{24}	6	0	0
	x_{17}	x_{18}	x_{22}

$\phi(1020)$ PARTIAL WIDTHS

$\Gamma(\eta\gamma)$ — Γ_5

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
58.9±0.5±2.4	ACHASOV	00	SND	$e^+e^- \to \eta\gamma$

$\Gamma(\pi^0\gamma)$ — Γ_6

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$5.40\pm0.16^{+0.43}_{-0.40}$	ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$

$\Gamma(\ell^+\ell^-)$ — Γ_7

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.320±0.017±0.015	[1] AMBROSINO	05	KLOE	1.02 $e^+e^- \to \mu^+\mu^-$

[1] Weighted average of Γ_{ee} and $\sqrt{\Gamma_{ee}\Gamma_{\mu\mu}}$ from AMBROSINO 05 assuming lepton universality.

$\Gamma(e^+e^-)$ — Γ_8

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
1.27 ±0.04 OUR EVALUATION				
1.251±0.021 OUR AVERAGE	Error includes scale factor of 1.1.			
1.235±0.006±0.022	[1] AKHMETSHIN	11	CMD2	1.02 $e^+e^- \to \phi$

1.32 ±0.05 ±0.03	[2] AMBROSINO 05	KLOE	1.02 $e^+e^- \to e^+e^-$
1.28 ±0.05	AKHMETSHIN 95	CMD2	1.02 $e^+e^- \to \phi$

[1] Combined analysis of the CMD-2 data on $\phi \to K^+K^-$, $K^0_S K^0_L$, $\pi^+\pi^-\pi^0$, $\eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007.

[2] From forward-backward asymmetry and using Γ_{total} = 4.26 ± 0.05 MeV from the 2004 edition of this Review.

$(\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-))^{1/2}$ — $(\Gamma_8\Gamma_9)^{1/2}$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.320±0.018±0.017	AMBROSINO 05	KLOE	1.02 $e^+e^- \to \mu^+\mu^-$

ϕ(1020) Γ(i)Γ(e^+e^-)/Γ(total)

$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_1\Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.6340±0.0070±0.0039		[1] LEES 13Q	BABR	$e^+e^- \to K^+K^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.669 ±0.001 ±0.023	1.7M	KOZYREV 18	CMD3	$e^+e^- \to K^+K^-$

[1] Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for ρ(770), ω(782), ϕ(1020) and their higher mass excitations. The first error combines statistical and systematic uncertainties. The second one is due to the parametrization of the charged kaon form factor and mass calibration.

$\Gamma(K^0_L K^0_S) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_2\Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.4200±0.0033±0.0123	28k	[1] LEES 14H	BABR	$e^+e^- \to K^0_S K^0_L \gamma$

[1] Using a vector meson dominance model with contribution from ϕ(1020) and higher mass excitations of ρ(770), ω(782), and ϕ(1020).

$[\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)] \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_3\Gamma_8/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
184.1±2.1±8.0	[1] LEES 21B	BABR	10.5 $e^+e^- \to \pi^+\pi^-\pi^0\gamma$

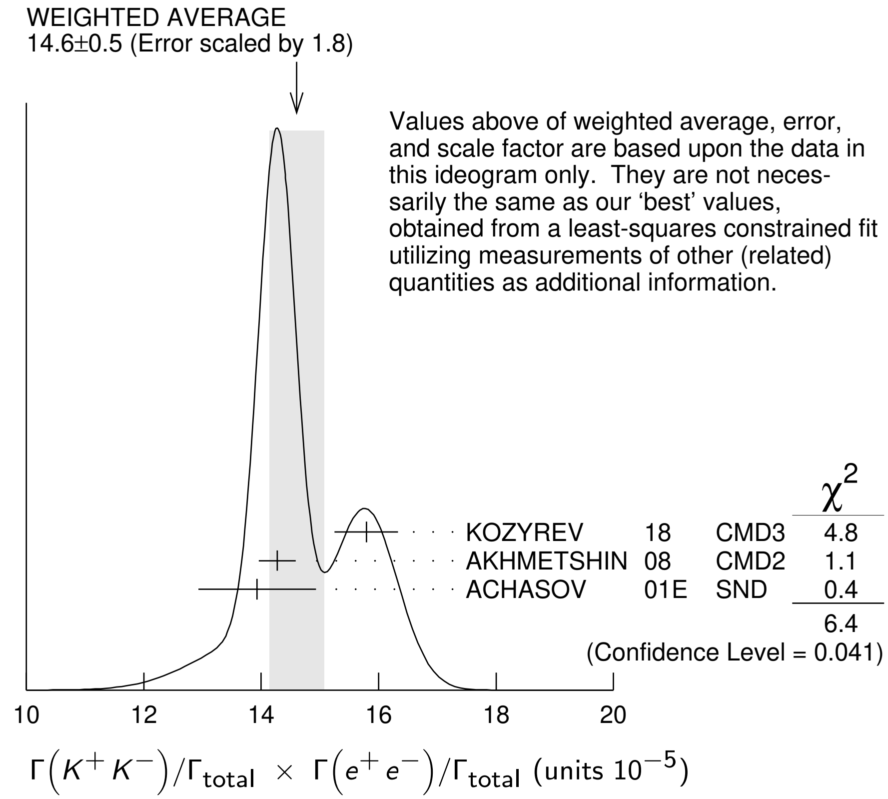
[1] From the cross section for $e^+e^- \to \pi^+\pi^-\pi^0$ with contributions from ρ(770), ω(782), ϕ(1020), ω(1420), and ω(1650).

ϕ(1020) Γ(i)Γ(e^+e^-)/Γ²(total)

$\Gamma(K^+K^-)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_1/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
14.79 ±0.30 OUR FIT Error includes scale factor of 1.5.				
14.6 ±0.5 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.				
15.789±0.541	1.7M	KOZYREV 18	CMD3	$e^+e^- \to K^+K^-$
14.27 ±0.05 ±0.31	542k	AKHMETSHIN 08	CMD2	1.02 $e^+e^- \to K^+K^-$
13.93 ±0.14 ±0.99	1000k	[1] ACHASOV 01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$

[1] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^-, $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.



$\Gamma(K^0_L K^0_S)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ $\qquad$ $\Gamma_2/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
9.97 ±0.08 OUR FIT					
9.94 ±0.08 OUR AVERAGE					
9.85 ±0.03 ±0.10	1.28M	[1] ACHASOV	24	SND	$e^+e^- \to K^0_L K^0_S$
10.078±0.223	610k	[2] KOZYREV	16	CMD3	$e^+e^- \to K^0_S K^0_L$
10.01 ±0.04 ±0.17	272k	[3] AKHMETSHIN	04	CMD2	$e^+e^- \to K^0_L K^0_S$
10.27 ±0.07 ±0.34	500k	[4] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$

[1] From a fit of the cross section in the energy region $1.000 < \sqrt{s} < 1.100$ GeV using a vector meson dominance model with contribution from $\phi(1020)$, $\rho(770)$, $\omega(782)$ and higher vector resonances. The the first three points near the threshold are removed in the fit.

[2] KOZYREV 16 also reports $\Gamma(e^+e^-)$ B($\phi \to K^0_S K^0_L$) = $(0.428 \pm 0.001 \pm 0.009)$ keV.

[3] Update of AKHMETSHIN 99D

[4] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^-, $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

$[\Gamma(\rho\pi)+\Gamma(\pi^+\pi^-\pi^0)]/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_3/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.42 ±0.11 OUR FIT Error includes scale factor of 1.2.				
4.51 ±0.14 OUR AVERAGE				
4.51 ±0.16 ±0.11	105k	AKHMETSHIN 06	CMD2	0.98–1.06 $e^+e^- \to \pi^+\pi^-\pi^0$
4.665±0.042±0.261	400k	[1] ACHASOV 01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
4.35 ±0.27 ±0.08	11169	[2] AKHMETSHIN 98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.38 ±0.12		BENAYOUN 10	RVUE	0.4–1.05 e^+e^-
4.30 ±0.08 ±0.21		[3] AUBERT,B 04N	BABR	10.6 $e^+e^- \to \pi^+\pi^-\pi^0\gamma$

[1] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^-, $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

[2] Recalculated by us from the cross section in the peak.

[3] Superseeded by LEES 21B.

$\Gamma(\eta\gamma)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_5/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
3.87 ±0.07 OUR FIT Error includes scale factor of 1.2.				
3.93 ±0.09 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.				
4.050±0.067±0.118	33k	[1] ACHASOV 07B	SND	0.6–1.38 $e^+e^- \to \eta\gamma$
$4.093^{+0.040}_{-0.043}$±0.247	17.4k	[2] AKHMETSHIN 05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
3.850±0.041±0.159	23k	[3,4] AKHMETSHIN 01B	CMD2	$e^+e^- \to \eta\gamma$
4.00 ±0.04 ±0.11		[5] ACHASOV 00	SND	$e^+e^- \to \eta\gamma$
3.53 ±0.08 ±0.17	2200	[6,7] AKHMETSHIN 99F	CMD2	$e^+e^- \to \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.19 ±0.06		[8] BENAYOUN 10	RVUE	0.4–1.05 e^+e^-

[1] From a combined fit of $\sigma(e^+e^- \to \eta\gamma)$ with $\eta \to 3\pi^0$ and $\eta \to \pi^+\pi^-\pi^0$, and fixing B($\eta \to 3\pi^0$) / 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.

[2] From the $\eta \to 2\gamma$ decay and using B($\eta \to \gamma\gamma$) = 39.43 ± 0.26%.

[3] From the $\eta \to 3\pi^0$ decay and using B($\eta \to 3\pi^0$)= (32.24 ± 0.29) × 10^{-2}.

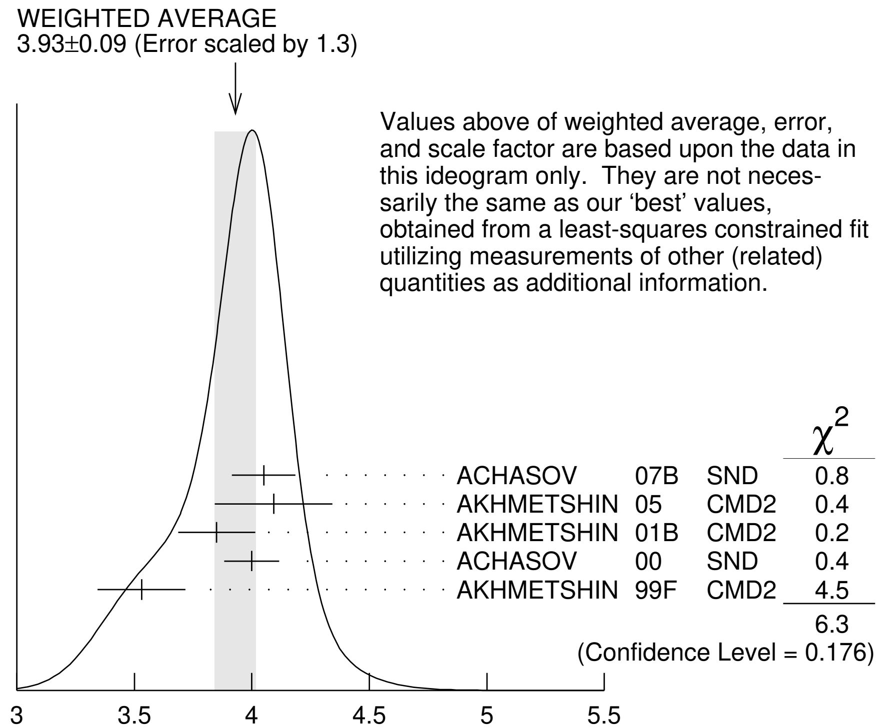
[4] The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).

[5] From the $\eta \to 2\gamma$ decay and using B($\eta \to 2\gamma$) =(39.21 ± 0.34) × 10^{-2}.

[6] Recalculated by the authors from the cross section in the peak.

[7] From the $\eta \to \pi^+\pi^-\pi^0$ decay and using B($\eta \to \pi^+\pi^-\pi^0$) =(23.1 ± 0.5) × 10^{-2}.

[8] A simultaneous fit of $e^+e^- \to \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.



$\Gamma(\eta\gamma)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_5/\Gamma \times \Gamma_8/\Gamma$

$\Gamma(\pi^0\gamma)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_6/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID		TECN	COMMENT
3.94±0.16 OUR FIT					
3.95±0.17 OUR AVERAGE					
4.04±0.09±0.19		[1] ACHASOV	16A	SND	0.60–1.38 $e^+e^- \to \pi^0\gamma$
3.75±0.11±0.29	18k	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.29±0.11		[2] BENAYOUN	10	RVUE	0.4–1.05 e^+e^-
$3.67\pm0.10^{+0.27}_{-0.25}$		[3] ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$

[1] From the VMD model with the interfering $\rho(770)$, $\omega(782)$, $\phi(1020)$ resonances, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 00.

[2] A simultaneous fit of $e^+e^- \to \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

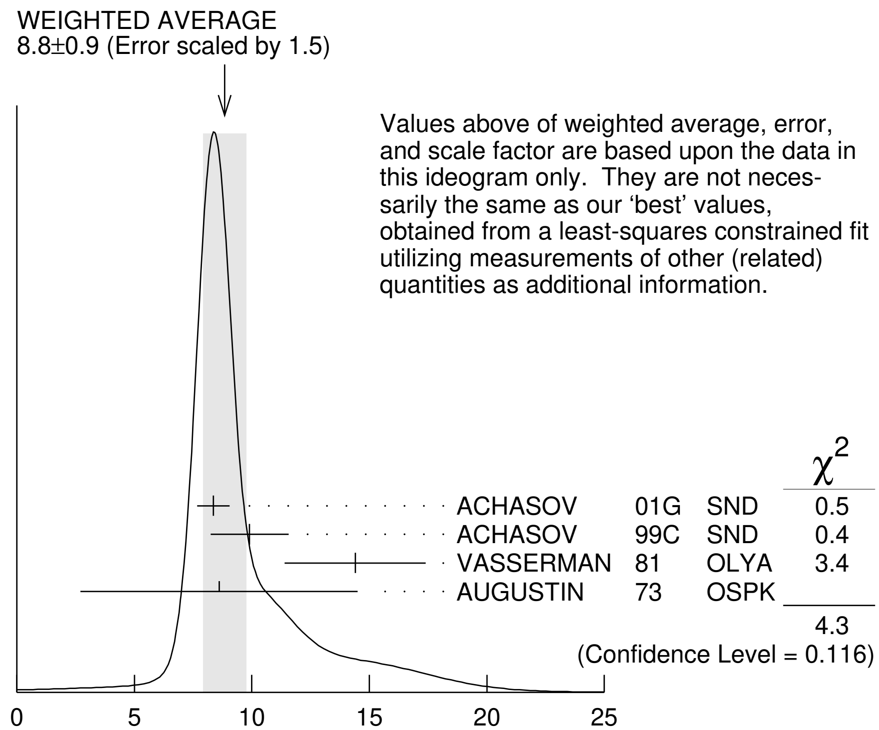
[3] From the $\pi^0 \to 2\gamma$ decay and using B($\pi^0 \to 2\gamma$) = (98.798 ± 0.032) × 10^{-2}.

$\Gamma(\mu^+\mu^-)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_9/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-8})	DOCUMENT ID		TECN	COMMENT
8.5 ±0.6 OUR FIT Error includes scale factor of 1.2.				
8.8 ±0.9 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.				
8.36±0.59±0.37	ACHASOV	01G	SND	$e^+e^- \to \mu^+\mu^-$
9.9 ±1.4 ±0.9	[1] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
14.4 ±3.0	[2] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
8.6 ±5.9	[2] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$

[1] Recalculated by the authors from the cross section in the peak.

[2] Recalculated by us from the cross section in the peak.

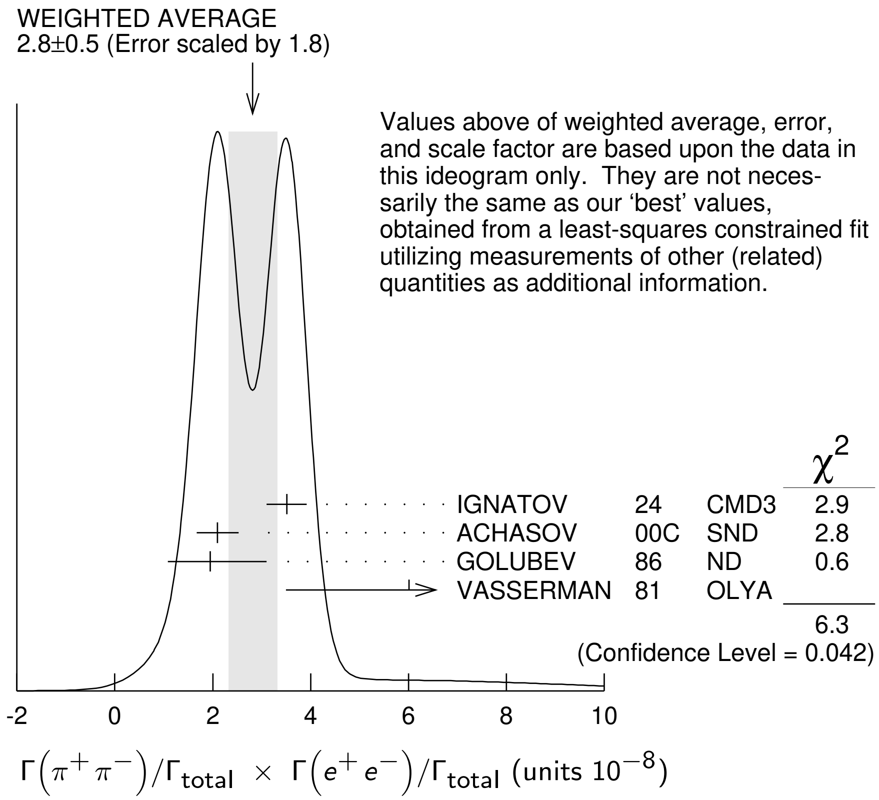


$\Gamma\left(\mu^+\mu^-\right)/\Gamma_{\rm total} \times \Gamma\left(e^+e^-\right)/\Gamma_{\rm total}$ $\Gamma_9/\Gamma \times \Gamma_8/\Gamma$

$\Gamma(\pi^+\pi^-)/\Gamma_{\rm total} \times \Gamma(e^+e^-)/\Gamma_{\rm total}$ $\Gamma_{11}/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID		TECN	COMMENT
2.8 ±0.6 OUR FIT Error includes scale factor of 2.0.					
2.8 ±0.5 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.					
$3.51 \pm 0.33 \pm 0.24$	34M	[1] IGNATOV	24	CMD3	$e^+e^- \to \pi^+\pi^-$
$2.1 \pm 0.3 \pm 0.3$		[2] ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$1.95^{+1.15}_{-0.87}$		[3] GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$6.01^{+3.19}_{-2.51}$		[3] VASSERMAN	81	OLYA	$e^+e^- \to \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.31 ± 0.99		[4] BENAYOUN	13	RVUE	0.4–1.05 e^+e^-

[1] From a fit of the pion form factor in the energy range $0.32 < \sqrt{s} < 1.2$ GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference with ω and ϕ masses and widths constrained by the values and their errors from PDG 22, and leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. A fit without the constraints from PDG 22 gives a value $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-)/\Gamma^2_{\rm total} = (3.65 \pm 0.24) \times 10^{-8}$.
[2] Recalculated by the authors from the cross section in the peak.
[3] Recalculated by us from the cross section in the peak.
[4] A simultaneous fit to $e^+e^- \to \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$, $K\overline{K}$, and $\tau^- \to \pi^-\pi^0\nu_\tau$ data.



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

VALUE (units 10^{-8})	*DOCUMENT ID*	*TECN*	*COMMENT*
1.40±0.15 OUR FIT			
1.37±0.17±0.01	[1,2] AMBROSINO 08G	KLOE	$e^+e^- \to \pi^+\pi^-2\pi^0$, $2\pi^0\gamma$

[1] Recalculated by the authors from the cross section at the peak.

[2] AMBROSINO 08G reports $[\Gamma(\phi(1020) \to \omega\pi^0)/\Gamma_{total} \times \Gamma(\phi(1020) \to e^+e^-)/\Gamma_{total}] \times [B(\omega(782) \to \pi^+\pi^-\pi^0)] = (1.22 \pm 0.13 \pm 0.08) \times 10^{-8}$ which we divide by our best value $B(\omega(782) \to \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{17}/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-8})	*DOCUMENT ID*	*TECN*	*COMMENT*
3.34±0.17 OUR FIT			
$\mathbf{3.33^{+0.04}_{-0.09}{}^{+0.19}_{-0.20}}$	[1] AMBROSINO 07	KLOE	$e^+e^- \to \pi^0\pi^0\gamma$

[1] Calculated by the authors from the cross section at the peak.

$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{18}/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-9})	*EVTS*	*DOCUMENT ID*	*TECN*	*COMMENT*
$\mathbf{1.2\ ^{+0.8}_{-0.7}}$ **OUR FIT**				
1.17±0.52±0.64	3285	[1] AKHMETSHIN 00E	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-$

[1] Recalculated by the authors from the cross section in the peak.

ϕ(1020) BRANCHING RATIOS

$\Gamma(K^+K^-)/\Gamma_{total}$ — Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.499±0.005 OUR FIT	Error includes scale factor of 1.5.				
0.493±0.010 OUR AVERAGE					
0.492±0.012	2913	AKHMETSHIN	95	CMD2	$e^+e^- \to K^+K^-$
0.44 ±0.05	321	KALBFLEISCH	76	HBC	2.18 $K^-p \to \Lambda K^+K^-$
0.49 ±0.06	270	DEGROOT	74	HBC	4.2 $K^-p \to \Lambda\phi$
0.540±0.034	565	BALAKIN	71	OSPK	$e^+e^- \to K^+K^-$
0.48 ±0.04	252	LINDSEY	66	HBC	2.1–2.7 $K^-p \to \Lambda K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.493±0.003±0.007		[1] AKHMETSHIN	11	CMD2	1.02 $e^+e^- \to K^+K^-$
0.476±0.017	1000k	[2] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$

[1] Combined analysis of the CMD-2 data on $\phi \to K^+K^-$, $K^0_S K^0_L$, $\pi^+\pi^-\pi^0$, $\eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007.

[2] Using B($\phi \to e^+e^-$)= (2.93 ± 0.14) × 10^{-4}.

$\Gamma(K^0_L K^0_S)/\Gamma_{total}$ — Γ_2/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.336±0.004 OUR FIT	Error includes scale factor of 1.3.				
0.331±0.009 OUR AVERAGE					
0.335±0.010	40644	AKHMETSHIN	95	CMD2	$e^+e^- \to K^0_L K^0_S$
0.326±0.035		DOLINSKY	91	ND	$e^+e^- \to K^0_L K^0_S$
0.310±0.024		DRUZHININ	84	ND	$e^+e^- \to K^0_L K^0_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.336±0.002±0.006		[1] AKHMETSHIN	11	CMD2	1.02 $e^+e^- \to K^0_S K^0_L$
0.351±0.013	500k	[2] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
0.27 ±0.03	133	KALBFLEISCH	76	HBC	2.18 $K^-p \to \Lambda K^0_L K^0_S$
0.257±0.030	95	[3] BALAKIN	71	OSPK	$e^+e^- \to K^0_L K^0_S$
0.40 ±0.04	167	LINDSEY	66	HBC	2.1–2.7 $K^-p \to \Lambda K^0_L K^0_S$

[1] Combined analysis of the CMD-2 data on $\phi \to K^+K^-$, $K^0_S K^0_L$, $\pi^+\pi^-\pi^0$, $\eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007.

[2] Using B($\phi \to e^+e^-$)= (2.93 ± 0.14) × 10^{-4}.

[3] Balakin error increased by Paul.

$\Gamma(K^0_L K^0_S)/\Gamma(K^+K^-)$ — Γ_2/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.674±0.014 OUR FIT	Error includes scale factor of 1.4.				
0.740±0.031 OUR AVERAGE					
0.70 ±0.06	2732	BUKIN	78C	OLYA	$e^+e^- \to K^0_L K^0_S$
0.82 ±0.08		LOSTY	78	HBC	4.2 $K^-p \to \phi$hyperon
0.71 ±0.05		LAVEN	77	HBC	10 $K^-p \to K^+K^-\Lambda$
0.71 ±0.08		LYONS	77	HBC	3–4 $K^-p \to \Lambda\phi$
0.89 ±0.10	144	AGUILAR-...	72B	HBC	3.9,4.6 K^-p

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

0.644 ± 0.017		[1] DUBNICKA	24	RVUE	$e^+e^- \to K^+K^-$, $K^0_S K^0_L$
0.638 ± 0.022	2.3M	[2] KOZYREV	18	CMD3	$e^+e^- \to K^0_L K^0_S$, K^+K^-
0.68 ± 0.03		[3] AKHMETSHIN	95	CMD2	$e^+e^- \to K^0_L K^0_S$, K^+K^-

[1] From a fit to CMD3, BABAR and BES3 data.

[2] The prediction taking into account phase-space difference, radiative corrections, isospin breaking, and the Sommerfeld-Gamow-Sakharov factor gives 0.630.

[3] Theoretical analysis of BRAMON 00 taking into account phase-space difference, electromagnetic radiative corrections, as well as isospin breaking, predicts 0.62. FLOREZ-BAEZ 08 predicts 0.63 considering also structure-dependent radiative corrections. FISCHBACH 02 calculates additional corrections caused by the close threshold and predicts 0.68. See also BENAYOUN 01 and DUBYNSKIY 07. BENAYOUN 12 obtains 0.71 ± 0.01 in the HLS model.

$\Gamma(K^0_L K^0_S)/\Gamma(K\overline{K})$ $\Gamma_2/(\Gamma_1+\Gamma_2)$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.403 ± 0.005 OUR FIT Error includes scale factor of 1.4.					
0.45 ± 0.04 OUR AVERAGE					
0.44 ± 0.07		[1] LONDON	66	HBC	2.24 $K^- p \to \Lambda K\overline{K}$
0.48 ± 0.07	52	BADIER	65B	HBC	3 $K^- p$
0.40 ± 0.10	34	SCHLEIN	63	HBC	1.95 $K^- p \to \Lambda K\overline{K}$

[1] This is probably not affected by their controversial background subtraction; the value is from their numbers of $K_1 K_2$ vs K^+K^- events.

$\left[\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)\right]/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.149 ± 0.004 OUR FIT Error includes scale factor of 1.3.					
0.151 ± 0.009 OUR AVERAGE Error includes scale factor of 1.7.					
0.161 ± 0.008	11761	AKHMETSHIN	95	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
0.143 ± 0.007		DOLINSKY	91	ND	$e^+e^- \to \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.155 ± 0.002 ± 0.005		[1] AKHMETSHIN	11	CMD2	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
0.159 ± 0.008	400k	[2] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
0.145 ± 0.009 ± 0.003	11169	[3] AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
0.139 ± 0.007		[4] PARROUR	76B	OSPK	e^+e^-

[1] Combined analysis of the CMD-2 data on $\phi \to K^+K^-$, $K^0_S K^0_L$, $\pi^+\pi^-\pi^0$, $\eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007.

[2] Using B($\phi \to e^+e^-$)= (2.93 ± 0.14) × 10^{-4}.

[3] Using B($\phi \to e^+e^-$)=(2.99 ± 0.08) × 10^{-4}.

[4] Using Γ(ϕ)= 4.1 MeV. If interference between the $\rho\pi$ and 3π modes is neglected, the fraction of the $\rho\pi$ is more than 80% at the 90% confidence level.

$\left[\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)\right]/\Gamma(K^+K^-)$ Γ_3/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.299 ± 0.010 OUR FIT Error includes scale factor of 1.4.					
0.232 ± 0.017 OUR AVERAGE					
0.230 ± 0.014 ± 0.010		ABLIKIM	25A	BES3	$D^+_s \to \phi\pi^+$
0.28 ± 0.09	34	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p$

$\left[\Gamma(\rho\pi)+\Gamma(\pi^+\pi^-\pi^0)\right]/\Gamma(K\overline{K})$ — $\Gamma_3/(\Gamma_1+\Gamma_2)$

VALUE	DOCUMENT ID		TECN	COMMENT
0.178±0.005 OUR FIT Error includes scale factor of 1.3.				
0.24 ±0.04 OUR AVERAGE				
0.237±0.039	CERRADA	77B	HBC	4.2 $K^- p \to \Lambda 3\pi$
0.30 ±0.15	LONDON	66	HBC	2.24 $K^- p \to \Lambda\pi^+\pi^-\pi^0$

$\left[\Gamma(\rho\pi)+\Gamma(\pi^+\pi^-\pi^0)\right]/\Gamma(K^0_L K^0_S)$ — Γ_3/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.443±0.012 OUR FIT Error includes scale factor of 1.2.					
0.51 ±0.05 OUR AVERAGE					
0.56 ±0.07	3681	BUKIN	78C	OLYA	$e^+e^- \to K^0_L K^0_S, \pi^+\pi^-\pi^0$
0.47 ±0.06	516	COSME	74	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_4/Γ

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$\simeq 0.0087$		1.98M	[1,2] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
<0.0006	90		[3] ACHASOV	02	SND	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
<0.23	90		[3] CORDIER	80	DM1	$e^+e^- \to \pi^+\pi^-\pi^0$
<0.20	90		[3] PARROUR	76B	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$

[1] From a fit without limitations on charged and neutral ρ masses and widths.
[2] Adding the direct and $\omega\pi$ contributions and considering the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.
[3] Neglecting the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.306±0.024 OUR FIT Error includes scale factor of 1.2.					
1.26 ±0.04 OUR AVERAGE					
1.246±0.025±0.057	10k	[1] ACHASOV	98F	SND	$e^+e^- \to 7\gamma$
1.18 ±0.11	279	[2] AKHMETSHIN	95	CMD2	$e^+e^- \to \pi^+\pi^- 3\gamma$
1.30 ±0.06		[3] DRUZHININ	84	ND	$e^+e^- \to 3\gamma$
1.4 ±0.2		[4] DRUZHININ	84	ND	$e^+e^- \to 6\gamma$
0.88 ±0.20	290	KURDADZE	83C	OLYA	$e^+e^- \to 3\gamma$
1.35 ±0.29		ANDREWS	77	CNTR	6.7–10 γ Cu
1.5 ±0.4	54	[3] COSME	76	OSPK	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.38 ±0.02 ±0.02		[5] AKHMETSHIN	11	CMD2	1.02 $e^+e^- \to \eta\gamma$
1.37 ±0.05 ±0.02	33k	[6] ACHASOV	07B	SND	0.6–1.38 $e^+e^- \to \eta\gamma$
1.373±0.014±0.085	17.4k	[7,8] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
1.287±0.013±0.063		[9,10] AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
1.338±0.012±0.052		[11] ACHASOV	00	SND	$e^+e^- \to \eta\gamma$
1.18 ±0.03 ±0.06	2200	[12] AKHMETSHIN	99F	CMD2	$e^+e^- \to \eta\gamma$
1.21 ±0.07		[13] BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \to \eta\gamma$

[1] Using B($\phi \to e^+e^-$) = $(2.99 \pm 0.08) \times 10^{-4}$ and B($\eta \to 3\pi^0$)= $(32.2 \pm 0.4) \times 10^{-2}$.
[2] From $\pi^+\pi^-\pi^0$ decay mode of η.
[3] From 2γ decay mode of η.

[4] From $3\pi^0$ decay mode of η.
[5] Combined analysis of the CMD-2 data on $\phi \to K^+K^-$, $K^0_S K^0_L$, $\pi^+\pi^-\pi^0$, $\eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007.
[6] ACHASOV 07B reports $[\Gamma(\phi(1020) \to \eta\gamma)/\Gamma_{total}] \times [B(\phi(1020) \to e^+e^-)] = (4.050 \pm 0.067 \pm 0.118) \times 10^{-6}$ which we divide by our best value $B(\phi(1020) \to e^+e^-) = (2.964 \pm 0.033) \times 10^{-4}$. 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.
[7] Using $B(\phi \to e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$ and $B(\eta \to \gamma\gamma) = 39.43 \pm 0.26\%$.
[8] Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma^2_{total}$.
[9] Using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \to 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
[10] 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).
[11] From the $\eta \to 2\gamma$ decay and using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[12] From $\pi^+\pi^-\pi^0$ decay mode of η and using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[13] Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

$\Gamma(\pi^0\gamma)/\Gamma_{total}$ — Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.33 ±0.05 OUR FIT					
1.31 ±0.13 OUR AVERAGE					
1.30 ±0.13		DRUZHININ	84	ND	$e^+e^- \to 3\gamma$
1.4 ±0.5	32	COSME	76	OSPK	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.367±0.072		[1] ACHASOV	16A	SND	0.60–1.38 $e^+e^- \to \pi^0\gamma$
1.258±0.037±0.077	18k	[2,3] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
$1.226 \pm 0.036^{+0.096}_{-0.089}$		[4] ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$
1.26 ±0.17		[5] BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \to \pi^0\gamma$

[1] Using $B(\phi \to e^+e^-)$ from PDG 15. Supersedes ACHASOV 00.
[2] Using $B(\phi \to e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$.
[3] Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma^2_{total}$.
[4] From the $\pi^0 \to 2\gamma$ decay and using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[5] Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

$\Gamma(\eta\gamma)/\Gamma(\pi^0\gamma)$ — Γ_5/Γ_6

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$10.9 \pm 0.3^{+0.7}_{-0.8}$	ACHASOV	00	SND	$e^+e^- \to \eta\gamma$, $\pi^0\gamma$

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.964±0.033 OUR FIT Error includes scale factor of 1.4.					
2.98 ±0.07 OUR AVERAGE Error includes scale factor of 1.1.					
2.93 ±0.14	1900k	[1] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
2.88 ±0.09	55600	AKHMETSHIN	95	CMD2	$e^+e^- \to$ hadrons
3.00 ±0.21	3681	BUKIN	78C	OLYA	$e^+e^- \to$ hadrons

3.10 ±0.14		[2] PARROUR	76	OSPK	e^+e^-
3.3 ±0.3		COSME	74	OSPK	$e^+e^- \to$ hadrons
2.81 ±0.25	681	BALAKIN	71	OSPK	$e^+e^- \to$ hadrons
3.50 ±0.27		CHATELUS	71	OSPK	e^+e^-

[1] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^-, $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

[2] Using total width 4.2 MeV. They detect 3π mode and observe significant interference with ω tail. This is accounted for in the result quoted above.

$\Gamma(\mu^+\mu^-)/\Gamma_{total}$ — Γ_9/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
2.86 ±0.22 OUR FIT Error includes scale factor of 1.2.				
2.96 ±0.16 OUR AVERAGE Error includes scale factor of 1.1.				
2.69 ±0.46	[1] HAYES	71	CNTR	8.3,9.8 $\gamma C \to \mu^+\mu^- X$
2.17 ±0.60	[1] EARLES	70	CNTR	6.0 $\gamma C \to \mu^+\mu^- X$
• • • We use the following data for averages but not for fits. • • •				
3.045±0.049±0.148	[2] AAIJ	24B	LHCB	D^+, $D_s^+ \to \pi^+\phi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.87 ±0.20 ±0.14	[3] ACHASOV	01G	SND	$e^+e^- \to \mu^+\mu^-$
3.30 ±0.45 ±0.32	[4] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
4.83 ±1.02	[5] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
2.87 ±1.98	[5] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$

[1] Neglecting interference between resonance and continuum.

[2] Value not independent from the measurement of $B(\phi \to \mu^+\mu^-)/B(\phi \to e^+e^-)$.

[3] Using $B(\phi \to e^+e^-) = (2.91 \pm 0.07) \times 10^{-4}$.

[4] Using $B(\phi \to e^+e^-)=(2.99 \pm 0.08) \times 10^{-4}$.

[5] Recalculated by us using $B(\phi \to e^+e^-)= (2.99 \pm 0.08) \times 10^{-4}$.

$\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ — Γ_9/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.022±0.012±0.048	24k	AAIJ	24B	LHCB	D^+, $D_s^+ \to \pi^+\phi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.026±0.020±0.056	7.5k	AAIJ	24B	LHCB	$D^+ \to \pi^+\phi$
1.017±0.013±0.051	16.7k	AAIJ	24B	LHCB	$D_s^+ \to \pi^+\phi$

$\Gamma(\eta e^+e^-)/\Gamma_{total}$ — Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.08 ±0.04 OUR AVERAGE					
1.075±0.007±0.038	30k	[1] BABUSCI	15	KLOE	1.02 $e^+e^- \to \eta e^+e^-$
1.19 ±0.19 ±0.12	213	[2] ACHASOV	01B	SND	$e^+e^- \to \eta e^+e^-$
1.14 ±0.10 ±0.06	355	[3] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.13 ±0.14 ±0.07	183	[4] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
1.21 ±0.14 ±0.09	130	[5] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
1.04 ±0.20 ±0.08	42	[6] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
1.3 $^{+0.8}_{-0.6}$	7	GOLUBEV	85	ND	$e^+e^- \to \eta e^+e^-$

[1] Using B($\eta \to 3\pi^0$) = (32.57 ± 0.23)% from PDG 12.
[2] Using B($\eta \to \gamma\gamma$) = (39.25 ± 0.32)%, B($\phi \to \eta\gamma$) = (1.26 ± 0.06)%, and B($\phi \to e^+e^-$) = (3.00 ± 0.06) × 10^{-4}.
[3] The average of the branching ratios separately obtained from the $\eta \to \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$ decays.
[4] From $\eta \to \gamma\gamma$ decays and using B($\eta \to \gamma\gamma$) = (39.33 ± 0.25) × 10^{-2}, B($\eta \to \pi^+\pi^-\gamma$) = (4.75 ± 11) × 10^{-2}, and B($\phi \to \eta\gamma$) = (1.297 ± 0.033) × 10^{-2}.
[5] From $\eta \to 3\pi^0$ decays and using B($\pi^0 \to \gamma\gamma$) = (98.798 ± 0.033) × 10^{-2}, B($\eta \to 3\pi^0$) = (32.24 ± 0.29) × 10^{-2}, B($\eta \to \pi^+\pi^-\gamma$) = (4.75 ± 0.11) × 10^{-2}, and B($\phi \to \eta\gamma$) = (1.297 ± 0.033) × 10^{-2}.
[6] From $\eta \to \pi^+\pi^-\pi^0$ decays and using B($\pi^0 \to \gamma\gamma$) = (98.798 ± 0.033) × 10^{-2}, B($\pi^0 \to e^+e^-\gamma$) = (1.198 ± 0.032) × 10^{-2}, B($\eta \to \pi^+\pi^-\pi^0$) = (23.0 ± 0.4) × 10^{-2}, B($\phi \to \pi^+\pi^-\pi^0$) = (15.5 ± 0.6) × 10^{-2}, and B($\phi \to \eta\gamma$) = (1.297 ± 0.033) × 10^{-2}.

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.71±0.11±0.09		[1] ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$0.65^{+0.38}_{-0.29}$		[1] GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$2.01^{+1.07}_{-0.84}$		[1] VASSERMAN	81	OLYA	$e^+e^- \to \pi^+\pi^-$
<6.6	95	BUKIN	78B	OLYA	$e^+e^- \to \pi^+\pi^-$
<2.7	95	ALVENSLEB...	72	CNTR	6.7 $\gamma C \to C\pi^+\pi^-$

[1] Using B($\phi \to e^+e^-$)=(2.99 ± 0.08) × 10^{-4}.

$\Gamma(\omega\pi^0)/\Gamma_{total}$ — Γ_{12}/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
4.7±0.5 OUR FIT				
$\mathbf{5.2^{+1.3}_{-1.1}}$	[1,2] AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.4±0.6	[3] AMBROSINO	08G	KLOE	$e^+e^- \to \pi^+\pi^- 2\pi^0$, $2\pi^0\gamma$
∼ 5.4	[4] ACHASOV	00E	SND	$e^+e^- \to \pi^0\pi^0\gamma$
$5.5^{+1.6}_{-1.4}$±0.3	[2,5] AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
$4.8^{+1.9}_{-1.7}$±0.8	[4] ACHASOV	99	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$

[1] Using the 1996 and 1998 data.
[2] (2.3 ± 0.3)% correction for other decay modes of the $\omega(782)$ applied.
[3] Not independent of the corresponding $\Gamma(\omega\pi^0) \times \Gamma(e^+e^-) / \Gamma^2$(total).
[4] Using the 1996 data.
[5] Using the 1998 data.

$\Gamma(\omega\gamma)/\Gamma_{total}$ — Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.05	84	LINDSEY	66	HBC	2.1–2.7 $K^- p \to \Lambda\pi^+\pi^-$ neutrals

$\Gamma(\rho\gamma)/\Gamma_{total}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 0.12	90	[1] AKHMETSHIN	99B	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 7	90	AKHMETSHIN	97C	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$
<200	84	LINDSEY	66	HBC	2.1–2.7 $K^- p \to \Lambda\pi^+\pi^-$ neutrals

[1] Supersedes AKHMETSHIN 97C.

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.41±0.12±0.04		30175	[1] AKHMETSHIN	99B	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 0.3	90		[2] AKHMETSHIN	97C	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$
<600	90		KALBFLEISCH	75	HBC	2.18 $K^- p \to \Lambda\pi^+\pi^-\gamma$
< 70	90		COSME	74	OSPK	$e^+e^- \to \pi^+\pi^-\gamma$
<400	90		LINDSEY	65	HBC	2.1–2.7 $K^- p \to \Lambda\pi^+\pi^-$ neutrals

[1] For $E_\gamma > 20$ MeV and assuming that B(ϕ(1020) $\to$ $f_0(980)\gamma$) is negligible. Supersedes AKHMETSHIN 97C.

[2] For $E_\gamma > 20$ MeV and assuming that B(ϕ(1020) $\to$ $f_0(980)\gamma$) is negligible.

$\Gamma(f_0(980)\gamma)/\Gamma_{total}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
3.22±0.19 OUR FIT Error includes scale factor of 1.1.						
3.21±0.19 OUR AVERAGE						
$3.21^{+0.03}_{-0.09}\pm0.18$			[1] AMBROSINO	07	KLOE	$e^+e^- \to \pi^0\pi^0\gamma$
2.90±0.21±1.54			[2] AKHMETSHIN	99C	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
4.47±0.21		2438	[3] ALOISIO	02D	KLOE	$e^+e^- \to \pi^0\pi^0\gamma$
$3.5\ \pm0.3\ ^{+1.3}_{-0.5}$		419	[4,5] ACHASOV	00H	SND	$e^+e^- \to \pi^0\pi^0\gamma$
1.93±0.46±0.50		27188	[6] AKHMETSHIN	99B	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$
3.05±0.25±0.72		268	[7] AKHMETSHIN	99C	CMD2	$e^+e^- \to \pi^0\pi^0\gamma$
1.5 ±0.5		268	[8] AKHMETSHIN	99C	CMD2	$e^+e^- \to \pi^0\pi^0\gamma$
3.42±0.30±0.36		164	[4] ACHASOV	98I	SND	$e^+e^- \to 5\gamma$
< 1	90		[9] AKHMETSHIN	97C	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$
< 7	90		[10] AKHMETSHIN	97C	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$
< 20	90		DRUZHININ	87	ND	$e^+e^- \to \pi^0\pi^0\gamma$

[1] Obtained by the authors taking into account the $\pi^+\pi^-$ decay mode. Includes a component due to $\pi\pi$ production via the $f_0(500)$ meson. Supersedes ALOISIO 02D.

[2] From the combined fit of the photon spectra in the reactions $e^+e^- \to \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.

[3] From the negative interference with the $f_0(500)$ meson of AITALA 01B using the ACHASOV 89 parameterization for the $f_0(980)$, a Breit-Wigner for the $f_0(500)$, and ACHASOV 01F for the $\rho\pi$ contribution. Superseded by AMBROSINO 07.

[4] Assuming that the $\pi^0\pi^0\gamma$ final state is completely determined by the $f_0\gamma$ mechanism, neglecting the decay B($\phi \to K\overline{K}\gamma$) and using B($f_0 \to \pi^+\pi^-$)= 2B($f_0 \to \pi^0\pi^0$).
[5] Using the value B($\phi \to \eta\gamma$)=(1.338 ± 0.053) × 10^{-2}.
[6] For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.
[7] Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).
[8] A narrow pole fit taking into account f_0(980) and f_0(1200) intermediate mechanisms.
[9] For destructive interference with the Bremsstrahlung process
[10] For constructive interference with the Bremsstrahlung process

$\Gamma(f_0(980)\gamma)/\Gamma(\eta\gamma)$ — Γ_{16}/Γ_5

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.47±0.15 OUR FIT Error includes scale factor of 1.1.				
2.6 ±0.2 $^{+0.8}_{-0.3}$	419	[1] ACHASOV 00H	SND	$e^+e^- \to \pi^0\pi^0\gamma$

[1] Assuming that the $\pi^0\pi^0\gamma$ final state is completely determined by the $f_0\gamma$ mechanism, neglecting the decay B($\phi \to K\overline{K}\gamma$) and using B($f_0 \to \pi^+\pi^-$)= 2B($f_0 \to \pi^0\pi^0$).

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.07 ±0.06 OUR AVERAGE					
1.07 $^{+0.01}_{-0.03}$ $^{+0.06}_{-0.06}$			[1] AMBROSINO 07	KLOE	$e^+e^- \to \pi^0\pi^0\gamma$
1.08 ±0.17 ±0.09		268	AKHMETSHIN 99C	CMD2	$e^+e^- \to \pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.09 ±0.03 ±0.05		2438	ALOISIO 02D	KLOE	$e^+e^- \to \pi^0\pi^0\gamma$
1.158±0.093±0.052		419	[2,3] ACHASOV 00H	SND	$e^+e^- \to \pi^0\pi^0\gamma$
<10	90		DRUZHININ 87	ND	$e^+e^- \to 5\gamma$

[1] Supersedes ALOISIO 02D.
[2] Using the value B($\phi \to \eta\gamma$)=(1.338 ± 0.053) × 10^{-2}.
[3] Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.

$\Gamma(\pi^0\pi^0\gamma)/\Gamma(\eta\gamma)$ — Γ_{17}/Γ_5

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.86 ±0.04 OUR FIT				
0.865±0.070±0.017	419	[1] ACHASOV 00H	SND	$e^+e^- \to \pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.90 ±0.08 ±0.07	164	ACHASOV 98I	SND	$e^+e^- \to 5\gamma$

[1] Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.

$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{total}$ — Γ_{18}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.5 ±2.7 ±1.6		6.8k	[1] AKHMETSHIN 17	CMD3	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.93±1.74±2.14		3.3k	AKHMETSHIN 00E	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-$
< 870	90		CORDIER 79	WIRE	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-$

[1] Using the cross section at the ϕ meson peak $\sigma(\phi) = 4172 \pm 42$ nb, the nonresonant cross section $\sigma(0) = 1.263 \pm 0.027$ nb and Re(Z) = 0.146 ± 0.030, Im(Z) = -0.002 ± 0.024 for the complex amplitude of the $\phi \to \pi^+\pi^-\pi^+\pi^-$ transition.

$\Gamma(\pi^+\pi^+\pi^-\pi^-\pi^0)/\Gamma_{total}$ Γ_{19}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
< 4.6	90	AKHMETSHIN	00E	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<150	95	BARKOV	88	CMD	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-\pi^0$

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{total}$ Γ_{20}/Γ

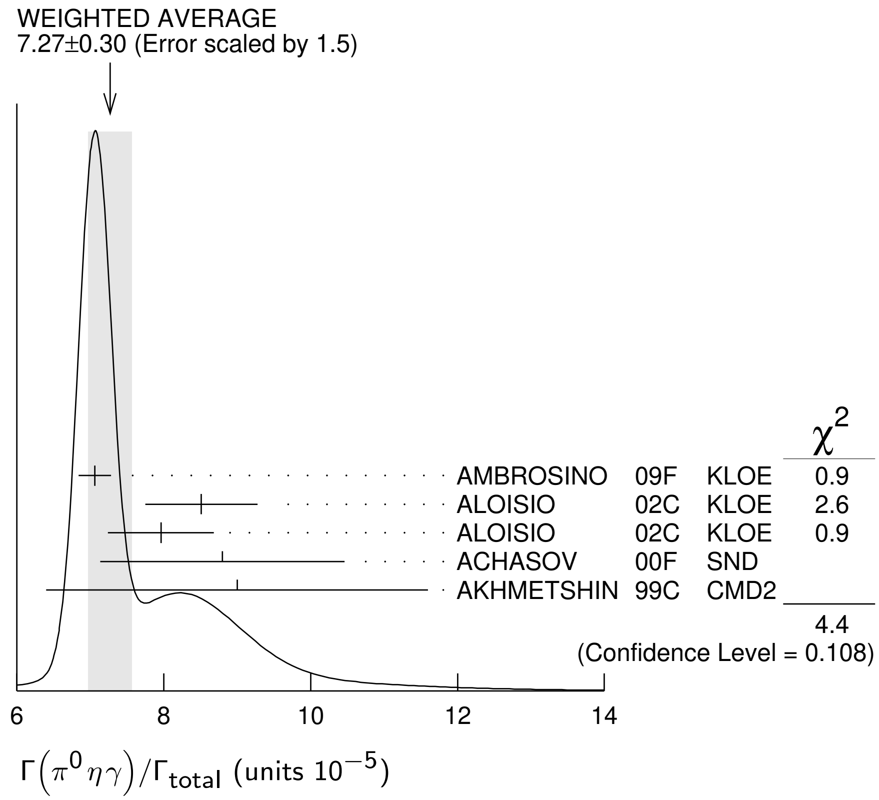
VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$1.33^{+0.07}_{-0.10}$ OUR AVERAGE						
$1.35\pm0.05^{+0.05}_{-0.10}$		9.5k	[1] ANASTASI	16B	KLOE	$e^+e^- \to \pi^0 e^+e^-$
$1.01\pm0.28\pm0.29$		52	[2] ACHASOV	02D	SND	$e^+e^- \to \pi^0 e^+e^-$
$1.22\pm0.34\pm0.21$		46	[3] AKHMETSHIN	01C	CMD2	$e^+e^- \to \pi^0 e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<12	90		DOLINSKY	88	ND	$e^+e^- \to \pi^0 e^+e^-$

[1] Using $B(\pi^0 \to \gamma\gamma)$ from the 2014 Edition of this Review (PDG 14).
[2] Using various branching ratios from the 2000 Edition of this Review (PDG 00).
[3] Using $B(\pi^0 \to \gamma\gamma) = 0.98798 \pm 0.00032$, $B(\phi \to \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$, and $B(\eta \to \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$.

$\Gamma(\pi^0\eta\gamma)/\Gamma_{total}$ Γ_{21}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
7.27±0.30 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.						
7.06 ± 0.22		16.9k	[1] AMBROSINO	09F	KLOE	1.02 $e^+e^- \to \eta\pi^0\gamma$
$8.51\pm0.51\pm0.57$		607	[2] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
$7.96\pm0.60\pm0.40$		197	[3] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
$8.8\ \pm1.4\ \pm0.9$		36	[4] ACHASOV	00F	SND	$e^+e^- \to \eta\pi^0\gamma$
$9.0\ \pm2.4\ \pm1.0$		80	AKHMETSHIN	99C	CMD2	$e^+e^- \to \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$7.01\pm0.10\pm0.20$		13.3k	[2,5] AMBROSINO	09F	KLOE	1.02 $e^+e^- \to \eta\pi^0\gamma$
$7.12\pm0.13\pm0.22$		3.6k	[3,6] AMBROSINO	09F	KLOE	1.02 $e^+e^- \to \eta\pi^0\gamma$
$8.3\ \pm2.3\ \pm1.2$		20	ACHASOV	98B	SND	$e^+e^- \to 5\gamma$
<250	90		DOLINSKY	91	ND	$e^+e^- \to \pi^0\eta\gamma$

[1] Combined results of $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decay modes measurements.
[2] From the decay mode $\eta \to \gamma\gamma$.
[3] From the decay mode $\eta \to \pi^+\pi^-\pi^0$.
[4] Supersedes ACHASOV 98B.
[5] Using $B(\phi \to \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \to 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \to \gamma\gamma) = (39.31 \pm 0.20)\%$.
[6] Using $B(\phi \to \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \to 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \to \pi^+\pi^-\pi^0) = (22.73 \pm 0.28)\%$.



$\Gamma(a_0(980)\gamma)/\Gamma_{total}$ Γ_{22}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
7.6±0.6 OUR FIT						
7.6±0.6 OUR AVERAGE						
7.4±0.7			[1] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
8.8±1.7		36	[2] ACHASOV	00F	SND	$e^+e^- \to \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
11 ±2			[3] GOKALP	02	RVUE	$e^+e^- \to \eta\pi^0\gamma$
<500	90		DOLINSKY	91	ND	$e^+e^- \to \pi^0\eta\gamma$

[1] Using $M_{a_0(980)}$=984.8 MeV and assuming $a_0(980)\gamma$ dominance.

[2] Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.

[3] Using data of ACHASOV 00F.

$\Gamma(f_0(980)\gamma)/\Gamma(a_0(980)\gamma)$ Γ_{16}/Γ_{22}

VALUE	DOCUMENT ID		TECN	COMMENT
6.1±0.6	[1] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$

[1] Using results of ALOISIO 02D and assuming that $f_0(980)$ decays into $\pi\pi$ only and $a_0(980)$ into $\eta\pi$ only.

$\Gamma(K^0\overline{K}^0\gamma)/\Gamma_{total}$ Γ_{23}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.9 × 10^{-8}	90	AMBROSINO	09C	KLOE	$e^+e^- \to K^0_S K^0_S\gamma$

$\Gamma(\eta'(958)\gamma)/\Gamma_{total}$ — Γ_{24}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.23±0.21 OUR FIT					
6.24±0.30 OUR AVERAGE					
6.23±0.27±0.12		3407	[1] AMBROSINO 07A	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-7\gamma$
6.7 $^{+2.8}_{-2.4}$ ±0.8		12	[2] AULCHENKO 03B	SND	$e^+e^- \rightarrow \eta'\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
6.7 $^{+5.0}_{-4.2}$ ±1.5		7	AULCHENKO 03B	SND	$e^+e^- \rightarrow 7\gamma$
6.10±0.61±0.43		120	[3] ALOISIO 02E	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$
8.2 $^{+2.1}_{-1.9}$ ±1.1		21	[4] AKHMETSHIN 00B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
4.9 $^{+2.2}_{-1.8}$ ±0.6		9	[5] AKHMETSHIN 00F	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
6.4 ±1.6		30	[6] AKHMETSHIN 00F	CMD2	$e^+e^- \rightarrow \eta'(958)\gamma$
6.7 $^{+3.4}_{-2.9}$ ±1.0		5	[7] AULCHENKO 99	SND	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
<11	90		AULCHENKO 98	SND	$e^+e^- \rightarrow 7\gamma$
12 $^{+7}_{-5}$ ±2		6	[4] AKHMETSHIN 97B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
<41	90		DRUZHININ 87	ND	$e^+e^- \rightarrow \gamma\eta\pi^+\pi^-$

[1] AMBROSINO 07A reports $[\Gamma(\phi(1020) \rightarrow \eta'(958)\gamma)/\Gamma_{total}]$ / $[B(\phi(1020) \rightarrow \eta\gamma)]$ = $(4.77 \pm 0.09 \pm 0.19) \times 10^{-3}$ which we multiply by our best value $B(\phi(1020) \rightarrow \eta\gamma)$ = $(1.306 \pm 0.024) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
[2] Averaging AULCHENKO 03B with AULCHENKO 99.
[3] Using $B(\phi \rightarrow \eta\gamma)$= (1.297 ± 0.033)%.
[4] Using the value $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06) \times 10^{-2}$.
[5] Using $B(\phi \rightarrow K^0_L K^0_S)$ = (33.8 ± 0.6)%.
[6] Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.
[7] Using the value $B(\eta' \rightarrow \eta\pi^+\pi^-) = (43.7 \pm 1.5) \times 10^{-2}$ and $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.31) \times 10^{-2}$.

$\Gamma(\eta'(958)\gamma)/\Gamma(K^0_L K^0_S)$ — Γ_{24}/Γ_2

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.85±0.06 OUR FIT				
1.46$^{+0.64}_{-0.54}$±0.18	9	[1] AKHMETSHIN 00F	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$

[1] Using various branching ratios of K^0_S, K^0_L, η, η' from the 2000 edition (The European Physical Journal **C15** 1 (2000)) of this Review.

$\Gamma(\eta'(958)\gamma)/\Gamma(\eta\gamma)$ — Γ_{24}/Γ_5

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.77±0.15 OUR FIT				
4.78±0.20 OUR AVERAGE				
4.77±0.09±0.19	3407	AMBROSINO 07A	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-7\gamma$
4.70±0.47±0.31	120	[1] ALOISIO 02E	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$
6.5 $^{+1.7}_{-1.5}$ ±0.8	21	AKHMETSHIN 00B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$

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

$9.5\ ^{+5.2}_{-4.0}\ \pm 1.4$	6	[2] AKHMETSHIN 97B	CMD2	$e^+e^- \to \pi^+\pi^- 3\gamma$

[1] From the decay mode $\eta' \to \eta\pi^+\pi^-$, $\eta \to \gamma\gamma$.
[2] Superseded by AKHMETSHIN 00B.

$\Gamma(\eta\pi^0\pi^0\gamma)/\Gamma_{total}$ — Γ_{25}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	AULCHENKO 98	SND	$e^+e^- \to 7\gamma$

$\Gamma(\mu^+\mu^-\gamma)/\Gamma_{total}$ — Γ_{26}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.43±0.45±0.14	27188	[1] AKHMETSHIN 99B	CMD2	$e^+e^- \to \mu^+\mu^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.3 ±1.0	824 ± 33	[2] AKHMETSHIN 97C	CMD2	$e^+e^- \to \mu^+\mu^-\gamma$

[1] For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.
[2] For $E_\gamma > 20$ MeV.

$\Gamma(\rho\gamma\gamma)/\Gamma_{total}$ — Γ_{27}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	AULCHENKO 08	CMD2	$\phi \to \pi^+\pi^-\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<5	90	AKHMETSHIN 98	CMD2	$e^+e^- \to \pi^+\pi^-\gamma\gamma$

$\Gamma(\eta\pi^+\pi^-)/\Gamma_{total}$ — Γ_{28}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.8	90	AKHMETSHIN 00E	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 6.1	90	AULCHENKO 08	CMD2	$\phi \to \eta\pi^+\pi^-$
<30	90	AKHMETSHIN 98	CMD2	$e^+e^- \to \pi^+\pi^-\gamma\gamma$

$\Gamma(\eta\mu^+\mu^-)/\Gamma_{total}$ — Γ_{29}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<9.4	90	AKHMETSHIN 01	CMD2	$e^+e^- \to \eta e^+e^-$

$\Gamma(\eta U \to \eta e^+e^-)/\Gamma_{total}$ — Γ_{30}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1 × 10^{-6}	90	[1] BABUSCI 13B	KLOE	1.02 $e^+e^- \to \eta e^+e^-$

[1] For a narrow vector U with mass between 5 and 470 MeV, from the combined analysis of $\eta \to \pi^+\pi^-\pi^0$ and $\eta \to \pi^0\pi^0\pi^0$ from ARCHILLI 12. Measured 90% CL limits as a function of m_U range from 2.2×10^{-8} to 10^{-6}.

$\Gamma(\text{invisible})/\Gamma(K^+K^-)$ — Γ_{31}/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.4 × 10^{-4}	90	ABLIKIM 18S	BES3	$J/\psi \to \phi\eta \to \phi\pi^+\pi^-\pi^0$

Lepton Family number (LF) violating modes

$\Gamma(e^\pm\mu^\mp)/\Gamma_{total}$ — Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2 × 10^{-6}	90	ACHASOV	10A	SND	$e^+e^- \to e^\pm\mu^\mp$

$\pi^+\pi^-\pi^0$ / $\rho\pi$ AMPLITUDE RATIO a_1 IN DECAY OF $\phi \to \pi^+\pi^-\pi^0$

NIECKNIG 12 describes final-state interactions between the three pions in a dispersive framework using data on the $\pi\pi$ P-wave scattering phase shift.

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
9.1±1.2 OUR AVERAGE						
10.1±4.4±1.7		80k	[1] AKHMETSHIN	06	CMD2	1.017–1.021 $e^+e^- \to \pi^+\pi^-\pi^0$
9.0±1.1±0.6		1.98M	[2,3] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$-6 < a_1 < 6$		500k	[3] ACHASOV	02	SND	$e^+e^- \to \pi^+\pi^-\pi^0$
$-16 < a_1 < 11$	90	9.8k	[1,4] AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\gamma\gamma$

[1] Dalitz plot analysis taking into account interference between the contact and $\rho\pi$ amplitudes.
[2] From a fit without limitations on charged and neutral ρ masses and widths.
[3] Recalculated by us to match the notations of AKHMETSHIN 98.
[4] Assuming zero phase for the contact term.

PARAMETER β IN $\phi \to Pe^+e^-$ DECAYS

In the one-pole approximation the electromagnetic transition form factor for $\phi \to Pe^+e^-$ ($P = \pi,\eta$) is given as a function of the e^+e^- invariant mass squared, q^2, by the expression:

$$|F(q^2)|^2 = (1 - q^2/\Lambda^2)^{-2},$$

where vector meson dominance predicts parameter $\Lambda \approx 0.770$ GeV ($\Lambda^{-2} \approx 1.687$ GeV^{-2}). The slope of this form factor, $\beta = dF/dq^2(q^2{=}0)$, equals Λ^{-2} in this approximation.

The measurements below obtain β in the one-pole approximation.

PARAMETER β IN $\phi \to \pi^0e^+e^-$ DECAY

VALUE (GeV^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.02±0.11	9.5k	[1] ANASTASI	16B	KLOE	1.02 $e^+e^- \to \pi^0e^+e^-$

[1] The error combines statistical and systematic uncertainties.

PARAMETER β IN $\phi \to \eta e^+e^-$ DECAY

VALUE (GeV^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.29±0.13 OUR AVERAGE					
$1.28\pm0.10^{+0.09}_{-0.08}$	30k	BABUSCI	15	KLOE	1.02 $e^+e^- \to \eta e^+e^-$
3.8 ±1.8	213	[1] ACHASOV	01B	SND	1.02 $e^+e^- \to \eta e^+e^-$

[1] The uncertainty is statistical only. The systematic one is negligible, in comparison.

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AKHMETSHIN 95 PL B364 199 R.R. Akhmetshin *et al.* (Novosibirsk CMD-2 Collab.)
DOLINSKY 91 PRPL 202 99 S.I. Dolinsky *et al.* (NOVO)
KUHN 90 ZPHY C48 445 J.H. Kuhn *et al.* (MPIM)
ACHASOV 89 NP B315 465 N.N. Achasov, V.N. Ivanchenko
DOLINSKY 89 ZPHY C42 511 S.I. Dolinsky *et al.* (NOVO)
BARKOV 88 SJNP 47 248 L.M. Barkov *et al.* (NOVO)
Translated from YAF 47 393.
DOLINSKY 88 SJNP 48 277 S.I. Dolinsky *et al.* (NOVO)
Translated from YAF 48 442.
DRUZHININ 87 ZPHY C37 1 V.P. Druzhinin *et al.* (NOVO)
ARMSTRONG 86 PL 166B 245 T.A. Armstrong *et al.* (ATHU, BARI, BIRM+)
ATKINSON 86 ZPHY C30 521 M. Atkinson *et al.* (BONN, CERN, GLAS+)
BEBEK 86 PRL 56 1893 C. Bebek *et al.* (CLEO Collab.)
DAVENPORT 86 PR D33 2519 T.F. Davenport (TUFTS, ARIZ, FNAL, FSU, NDAM+)
DIJKSTRA 86 ZPHY C31 375 H. Dijkstra *et al.* (ANIK, BRIS, CERN+)
FRAME 86 NP B276 667 D. Frame *et al.* (GLAS)
GOLUBEV 86 SJNP 44 409 V.B. Golubev *et al.* (NOVO)
Translated from YAF 44 633.
ALBRECHT 85D PL 153B 343 H. Albrecht *et al.* (ARGUS Collab.)
GOLUBEV 85 SJNP 41 756 V.B. Golubev *et al.* (NOVO)
Translated from YAF 41 1183.
DRUZHININ 84 PL 144B 136 V.P. Druzhinin *et al.* (NOVO)
ARMSTRONG 83B NP B224 193 T.A. Armstrong *et al.* (BARI, BIRM, CERN+)
BARATE 83 PL 121B 449 R. Barate *et al.* (SACL, LOIC, SHMP, IND)
KURDADZE 83C JETPL 38 366 L.M. Kurdadze *et al.* (NOVO)
Translated from ZETFP 38 306.
ARENTON 82 PR D25 2241 M.W. Arenton *et al.* (ANL, ILL)
PELLINEN 82 PS 25 599 A. Pellinen, M. Roos (HELS)
DAUM 81 PL 100B 439 C. Daum *et al.* (AMST, BRIS, CERN, CRAC+)
IVANOV 81 PL 107B 297 P.M. Ivanov *et al.* (NOVO)
Also Private Comm. S.I. Eidelman (NOVO)
VASSERMAN 81 PL 99B 62 I.B. Vasserman *et al.* (NOVO)
Also SJNP 35 240 L.M. Kurdadze *et al.*
Translated from YAF 35 352.
CORDIER 80 NP B172 13 A. Cordier *et al.* (LALO)
CORDIER 79 PL 81B 389 A. Cordier *et al.* (LALO)
BUKIN 78B SJNP 27 521 A.D. Bukin *et al.* (NOVO)
Translated from YAF 27 985.

BUKIN	78C	SJNP 27 516	A.D. Bukin *et al.*	(NOVO)
		Translated from YAF 27 976.		
COOPER	78B	NP B146 1	A.M. Cooper *et al.*	(TATA, CERN, CDEF+)
LOSTY	78	NP B133 38	M.J. Losty *et al.*	(CERN, AMST, NIJM+)
AKERLOF	77	PRL 39 861	C.W. Akerlof *et al.*	(FNAL, MICH, PURD)
ANDREWS	77	PRL 38 198	D.E. Andrews *et al.*	(ROCH)
BALDI	77	PL 68B 381	R. Baldi *et al.*	(GEVA)
CERRADA	77B	NP B126 241	M. Cerrada *et al.*	(AMST, CERN, NIJM+)
COHEN	77	PRL 38 269	D. Cohen *et al.*	(ANL)
LAVEN	77	NP B127 43	H. Laven *et al.*	(AACH3, BERL, CERN, LOIC+)
LYONS	77	NP B125 207	L. Lyons, A.M. Cooper, A.G. Clark	(OXF)
COSME	76	PL 63B 352	G. Cosme *et al.*	(ORSAY)
KALBFLEISCH	76	PR D13 22	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
PARROUR	76	PL 63B 357	G. Parrour *et al.*	(ORSAY)
PARROUR	76B	PL 63B 362	G. Parrour *et al.*	(ORSAY)
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
AYRES	74	PRL 32 1463	D.S. Ayres *et al.*	(ANL)
BESCH	74	NP B70 257	H.J. Besch *et al.*	(BONN)
COSME	74	PL 48B 155	G. Cosme *et al.*	(ORSAY)
COSME	74B	PL 48B 159	G. Cosme *et al.*	(ORSAY)
DEGROOT	74	NP B74 77	A.J. de Groot *et al.*	(AMST, NIJM)
AUGUSTIN	73	PRL 30 462	J.E. Augustin *et al.*	(ORSAY)
BALLAM	73	PR D7 3150	J. Ballam *et al.*	(SLAC, LBL)
BINNIE	73B	PR D8 2789	D.M. Binnie *et al.*	(LOIC, SHMP)
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez *et al.*	(BNL)
ALVENSLEB...	72	PRL 28 66	H. Alvensleben *et al.*	(MIT, DESY)
BORENSTEIN	72	PR D5 1559	S.R. Borenstein *et al.*	(BNL, MICH)
COLLEY	72	NP B50 1	D.C. Colley *et al.*	(BIRM, GLAS)
BALAKIN	71	PL 34B 328	V.E. Balakin *et al.*	(NOVO)
CHATELUS	71	Thesis LAL 1247	Y. Chatelus	(STRB)
Also		PL 32B 416	J.C. Bizot *et al.*	(ORSAY)
HAYES	71	PR D4 899	S. Hayes *et al.*	(CORN)
STOTTLE...	71	Thesis ORO 2504 170	A.R. Stottlemyer	(UMD)
BIZOT	70	PL 32B 416	J.C. Bizot *et al.*	(ORSAY)
Also		Liverpool Sym. 69	J.P. Perez-y-Jorba	
EARLES	70	PRL 25 1312	D.R. Earles *et al.*	(NEAS)
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	
LINDSEY	66	PR 147 913	J.S. Lindsey, G. Smith	(LRL)
LONDON	66	PR 143 1034	G.W. London *et al.*	(BNL, SYRA) IGJPC
BADIER	65B	PL 17 337	J. Badier *et al.*	(EPOL, SACL, AMST)
LINDSEY	65	PRL 15 221	J.S. Lindsey, G.A. Smith	(LRL)
		LINDSEY 65 data included in LINDSEY 66.		
SCHLEIN	63	PRL 10 368	P.E. Schlein *et al.*	(UCLA) IGJP