$\phi(1020)$

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

$\phi(1020)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1019.461±0.016 OUR AVERAGE					
1019.463±0.061	2.3M	[1] KOZYREV	18	CMD3	$e^+e^- \to K^+K^-$, $K^0_S K^0_L$
1019.462±0.042±0.056	28k	[2] LEES	14H	BABR	$e^+e^- \to K^0_S K^0_L \gamma$
1019.51 ±0.02 ±0.05		[3] 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	[4] AKHMETSHIN	04	CMD2	$e^+e^- \to K^0_L K^0_S$
1019.42 ±0.05	1900k	[5] 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		[6] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$
1019.38 ±0.07 ±0.08	2200	[7] 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	[8] 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. • • •					
1019.54 ±0.10 ±0.51		[9] AAIJ	19H	LHCB	$pp \to D^{\pm}X$
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	[10] AKHMETSHIN	08	CMD2	1.02 $e^+e^- \to K^+K^-$
1019.63 ±0.07	12540	[11] AUBERT,B	05J	BABR	$D^0 \to \overline{K}^0 K^+K^-$
1019.8 ±0.7		ARMSTRONG	86	OMEG	85 $\pi^+/pp \to \pi^+/p4Kp$
1020.1 ±0.11	5526	[11] ATKINSON	86	OMEG	20–70 γp
1019.7 ±1.0		BEBEK	86	CLEO	$e^+e^- \to \Upsilon(4S)$
1019.411±0.008	642k	[12] DIJKSTRA	86	SPEC	100–200 $\pi^{\pm}$, $\overline{p}$, p, $K^{\pm}$, on Be
1020.9 ±0.2		[11] FRAME	86	OMEG	13 $K^+p \to \phi K^+p$
1021.0 ±0.2		[11] ARMSTRONG	83B	OMEG	18.5 $K^-p \to K^-K^+\Lambda$

1020.0	±0.5			[11] ARMSTRONG	83B	OMEG	18.5 $K^- p \to K^- K^+ \Lambda$
1019.7	±0.3			[11] 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	[11] 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	[13] AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \to \Lambda K^+ K^-$
1019.9	±0.5		100	[13] 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] Average of KOZYREV 16 and KOZYREV 18 values taking into account the correlated uncertainties. Supersedes individual KOZYREV 16 and KOZYREV 18 results.
[2] Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$.
[3] 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.
[4] Update of AKHMETSHIN 99D
[5] 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.
[6] Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included.
[7] Using a total width of 4.43 ± 0.05 MeV.
[8] PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DEGROOT 74.
[9] 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.
[10] Strongly correlated with AKHMETSHIN 04.
[11] Systematic errors not evaluated.
[12] Weighted and scaled average of 12 measurements of DIJKSTRA 86.
[13] Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

ϕ(1020) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
4.249±0.013 OUR AVERAGE		Error includes scale factor of 1.1.			
4.245±0.013	2.3M	[1] KOZYREV	18	CMD3	$e^+ e^- \to K^+ K^-$, $K^0_S K^0_L$
4.205±0.103±0.067	28k	[2] LEES	14H	BABR	$e^+ e^- \to K^0_S K^0_L \gamma$
4.29 ±0.04 ±0.07		[3] 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	[4] AKHMETSHIN	04	CMD2	$e^+ e^- \to K^0_L K^0_S$

4.21 ±0.04	1900k	[5] ACHASOV	01E	SND	$e^+e^- \rightarrow K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
4.44 ±0.09	55600	AKHMETSHIN	95	CMD2	$e^+e^- \rightarrow$ hadrons
4.5 ±0.7	1500	ARENTON	82	AEMS	11.8 polar. $pp \rightarrow KK$
4.2 ±0.6	766	[6] IVANOV	81	OLYA	1–1.4 $e^+e^- \rightarrow K^+K^-$
4.3 ±0.6		[6] CORDIER	80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.36 ±0.29	3681	[6] BUKIN	78C	OLYA	$e^+e^- \rightarrow$ hadrons
4.4 ±0.6	984	[6] BESCH	74	CNTR	2 $\gamma p \rightarrow pK^+K^-$
4.67 ±0.72	681	[6] BALAKIN	71	OSPK	$e^+e^- \rightarrow$ hadrons
4.09 ±0.29		BIZOT	70	OSPK	$e^+e^- \rightarrow$ hadrons

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

4.249±0.015	1.7M	KOZYREV	18	CMD3	$e^+e^- \rightarrow K^+K^-$
4.240±0.017	610k	KOZYREV	16	CMD3	$e^+e^- \rightarrow K^0_S K^0_L$
4.37 ±0.02		LEES	13F	BABR	$D^+ \rightarrow K^+K^-\pi^+$
4.24 ±0.02 ±0.03	542k	[7] AKHMETSHIN	08	CMD2	1.02 $e^+e^- \rightarrow K^+K^-$
4.28 ±0.13	12540	[8] AUBERT,B	05J	BABR	$D^0 \rightarrow \overline{K}^0 K^+K^-$
4.45 ±0.06	271k	DIJKSTRA	86	SPEC	100 π^- Be
3.6 ±0.8	337	[6] COOPER	78B	HBC	0.7–0.8 $\overline{p}p \rightarrow K^0_S K^0_L \pi^+\pi^-$
4.5 ±0.50	1300	[6,8] AKERLOF	77	SPEC	400 $pA \rightarrow K^+K^-X$
4.5 ±0.8	500	[6,8] AYRES	74	ASPK	3–6 $\pi^-p \rightarrow K^+K^-n$, $K^-p \rightarrow K^+K^-\Lambda/\Sigma^0$
3.81 ±0.37		COSME	74B	OSPK	$e^+e^- \rightarrow K^0_L K^0_S$
3.8 ±0.7	454	[6] BORENSTEIN	72	HBC	2.18 $K^-p \rightarrow K\overline{K}n$

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

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

[3] 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.

[4] Update of AKHMETSHIN 99D

[5] 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.

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

[7] Strongly correlated with AKHMETSHIN 04.

[8] Systematic errors not evaluated.

ϕ(1020) DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	K^+K^-	(49.2 ±0.5) %	S=1.3
Γ_2	$K^0_L K^0_S$	(34.0 ±0.4) %	S=1.3
Γ_3	$\rho\pi + \pi^+\pi^-\pi^0$	(15.24 ±0.33) %	S=1.2
Γ_4	$\rho\pi$		
Γ_5	$\pi^+\pi^-\pi^0$		
Γ_6	$\eta\gamma$	(1.303±0.025) %	S=1.2

Γ_{7}	$\pi^0 \gamma$		$(1.30 \pm 0.05) \times 10^{-3}$	
Γ_{8}	$\ell^+ \ell^-$		—	
Γ_{9}	$e^+ e^-$		$(2.973 \pm 0.034) \times 10^{-4}$	S=1.3
Γ_{10}	$\mu^+ \mu^-$		$(2.86 \pm 0.19) \times 10^{-4}$	
Γ_{11}	$\eta e^+ e^-$		$(1.08 \pm 0.04) \times 10^{-4}$	
Γ_{12}	$\pi^+ \pi^-$		$(7.3 \pm 1.3) \times 10^{-5}$	
Γ_{13}	$\omega \pi^0$		$(4.7 \pm 0.5) \times 10^{-5}$	
Γ_{14}	$\omega \gamma$		< 5 %	CL=84%
Γ_{15}	$\rho \gamma$		$< 1.2 \times 10^{-5}$	CL=90%
Γ_{16}	$\pi^+ \pi^- \gamma$		$(4.1 \pm 1.3) \times 10^{-5}$	
Γ_{17}	$f_0(980) \gamma$		$(3.22 \pm 0.19) \times 10^{-4}$	S=1.1
Γ_{18}	$\pi^0 \pi^0 \gamma$		$(1.12 \pm 0.06) \times 10^{-4}$	
Γ_{19}	$\pi^+ \pi^- \pi^+ \pi^-$		$(3.9 {}^{+2.8}_{-2.2}) \times 10^{-6}$	
Γ_{20}	$\pi^+ \pi^+ \pi^- \pi^- \pi^0$		$< 4.6 \times 10^{-6}$	CL=90%
Γ_{21}	$\pi^0 e^+ e^-$		$(1.33 {}^{+0.07}_{-0.10}) \times 10^{-5}$	
Γ_{22}	$\pi^0 \eta \gamma$		$(7.27 \pm 0.30) \times 10^{-5}$	S=1.5
Γ_{23}	$a_0(980) \gamma$		$(7.6 \pm 0.6) \times 10^{-5}$	
Γ_{24}	$K^0 \overline{K}^0 \gamma$		$< 1.9 \times 10^{-8}$	CL=90%
Γ_{25}	$\eta'(958) \gamma$		$(6.22 \pm 0.21) \times 10^{-5}$	
Γ_{26}	$\eta \pi^0 \pi^0 \gamma$		$< 2 \times 10^{-5}$	CL=90%
Γ_{27}	$\mu^+ \mu^- \gamma$		$(1.4 \pm 0.5) \times 10^{-5}$	
Γ_{28}	$\rho \gamma \gamma$		$< 1.2 \times 10^{-4}$	CL=90%
Γ_{29}	$\eta \pi^+ \pi^-$		$< 1.8 \times 10^{-5}$	CL=90%
Γ_{30}	$\eta \mu^+ \mu^-$		$< 9.4 \times 10^{-6}$	CL=90%
Γ_{31}	$\eta U \to \eta e^+ e^-$		$< 1 \times 10^{-6}$	CL=90%
Γ_{32}	invisible		$< 1.7 \times 10^{-4}$	CL=90%
	Lepton Family number (LF) violating modes			
Γ_{33}	$e^\pm \mu^\mp$	*LF*	$< 2 \times 10^{-6}$	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to 30 branching ratios uses 82 measurements and one constraint to determine 14 parameters. The overall fit has a $\chi^2 = 63.7$ for 69 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	−78									
x_3	−59	−4								
x_6	−23	19	6							
x_7	−15	14	4	10						
x_9	54	−52	−17	−38	−27					
x_{10}	−7	7	2	5	3	−13				
x_{12}	−3	3	1	2	2	−6	1			
x_{13}	−5	4	1	3	2	−8	1	1		
x_{17}	0	0	0	0	0	0	0	0	0	
x_{18}	−11	10	3	19	5	−20	2	1	2	0
x_{19}	−1	1	0	1	0	−2	0	0	0	0
x_{23}	0	0	0	0	0	0	0	0	0	0
x_{25}	−8	6	2	33	3	−12	2	1	1	0
	x_1	x_2	x_3	x_6	x_7	x_9	x_{10}	x_{12}	x_{13}	x_{17}

x_{19}	0		
x_{23}	0	0	
x_{25}	6	0	0
	x_{18}	x_{19}	x_{23}

ϕ(1020) PARTIAL WIDTHS

$\Gamma(\eta\gamma)$ Γ_6

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_7

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_8

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_9

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.

$(\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-))^{1/2}$ — $(\Gamma_9\Gamma_{10})^{1/2}$

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

$\phi(1020)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

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

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 $\rho(770)$, $\omega(782)$, $\phi(1020)$ 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.

$\Gamma(K^0_L K^0_S) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_2\Gamma_9/\Gamma$

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

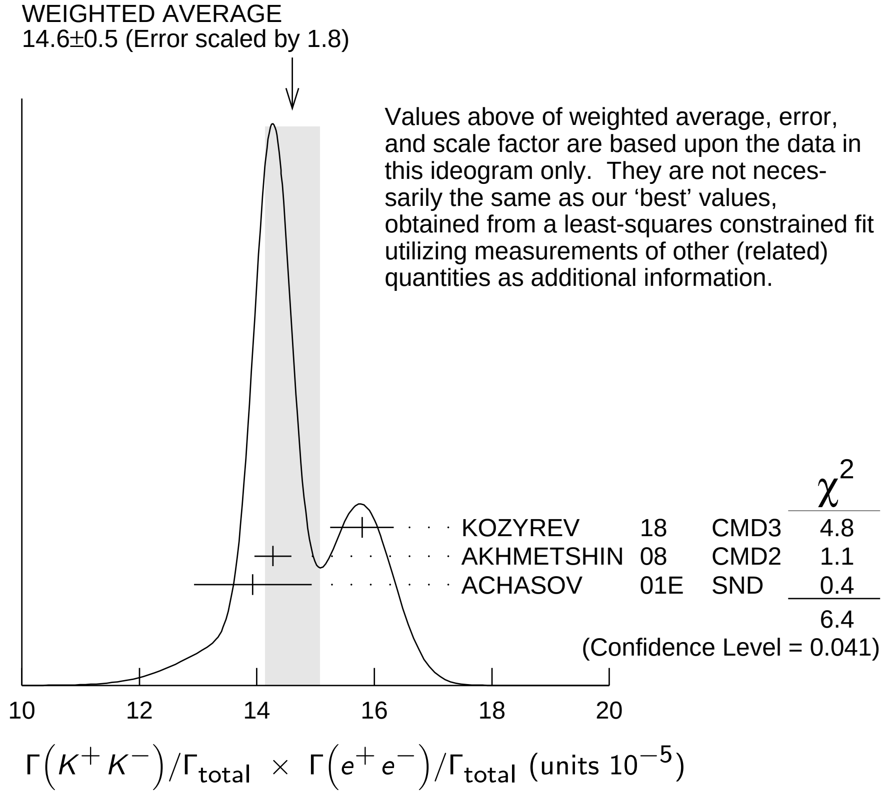
[1] Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$.

$\phi(1020)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
14.63 ±0.29 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.



$\Gamma(K^0_L K^0_S)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_2/\Gamma \times \Gamma_9/\Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
10.10 ±0.12 OUR FIT Error includes scale factor of 1.1.				
10.07 ±0.13 OUR AVERAGE				
10.078±0.223	610k	[1] KOZYREV 16	CMD3	$e^+e^- \to K^0_S K^0_L$
10.01 ±0.04 ±0.17	272k	[2] AKHMETSHIN 04	CMD2	$e^+e^- \to K^0_L K^0_S$
10.27 ±0.07 ±0.34	500k	[3] ACHASOV 01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$

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

[2] Update of AKHMETSHIN 99D

[3] 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.

$[\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)]/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_3/\Gamma \times \Gamma_9/\Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.53 ±0.10 OUR FIT Error includes scale factor of 1.1.				
4.46 ±0.12 OUR AVERAGE				
4.51 ±0.16 ±0.11	105k	AKHMETSHIN 06	CMD2	0.98–1.06 $e^+e^- \to \pi^+\pi^-\pi^0$
4.30 ±0.08 ±0.21		AUBERT,B 04N	BABR	10.6 $e^+e^- \to \pi^+\pi^-\pi^0\gamma$
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^-

[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.

$\Gamma(\eta\gamma)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_6/\Gamma \times \Gamma_9/\Gamma$

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 $e^+e^- \rightarrow \eta\gamma$
$4.093^{+0.040}_{-0.043}$±0.247	17.4k	[2] AKHMETSHIN 05	CMD2	0.60-1.38 $e^+e^- \rightarrow \eta\gamma$
3.850±0.041±0.159	23k	[3,4] AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
4.00 ±0.04 ±0.11		[5] ACHASOV 00	SND	$e^+e^- \rightarrow \eta\gamma$
3.53 ±0.08 ±0.17	2200	[6,7] AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \eta\gamma$
• • • 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 $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing B($\eta \rightarrow 3\pi^0$) / B($\eta \rightarrow \pi^+\pi^-\pi^0$) = 1.44 ± 0.04. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.

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

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

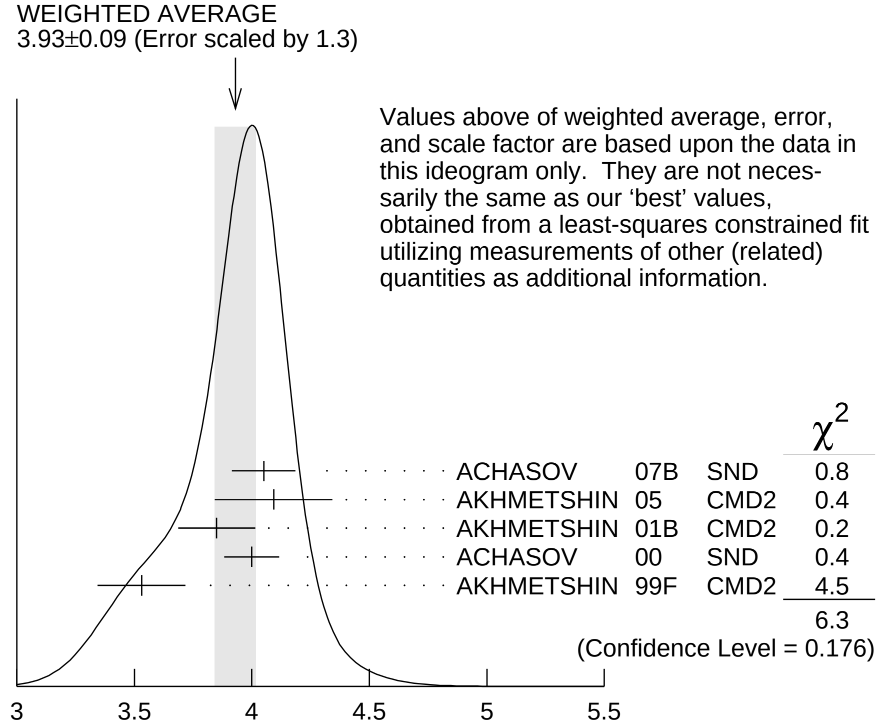
[4] The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).

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

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

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

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



$\Gamma\left(\eta\gamma\right)/\Gamma_{\rm total} \times \Gamma\left(e^+e^-\right)/\Gamma_{\rm total}$ $\qquad$ $\Gamma_6/\Gamma \times \Gamma_9/\Gamma$

$\Gamma(\pi^0\gamma)/\Gamma_{\rm total} \times \Gamma(e^+e^-)/\Gamma_{\rm total}$ $\qquad$ $\Gamma_7/\Gamma \times \Gamma_9/\Gamma$

VALUE (units 10^{-7})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3.88±0.14 OUR FIT					
3.87±0.15 OUR AVERAGE					
$4.04\pm0.09\pm0.19$		[1] ACHASOV	16A	SND	0.60–1.38 $e^+e^- \to \pi^0\gamma$
$3.75\pm0.11\pm0.29$	18k	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
$3.67\pm0.10{}^{+0.27}_{-0.25}$		[2] ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.29 ± 0.11		[3] BENAYOUN	10	RVUE	0.4–1.05 e^+e^-

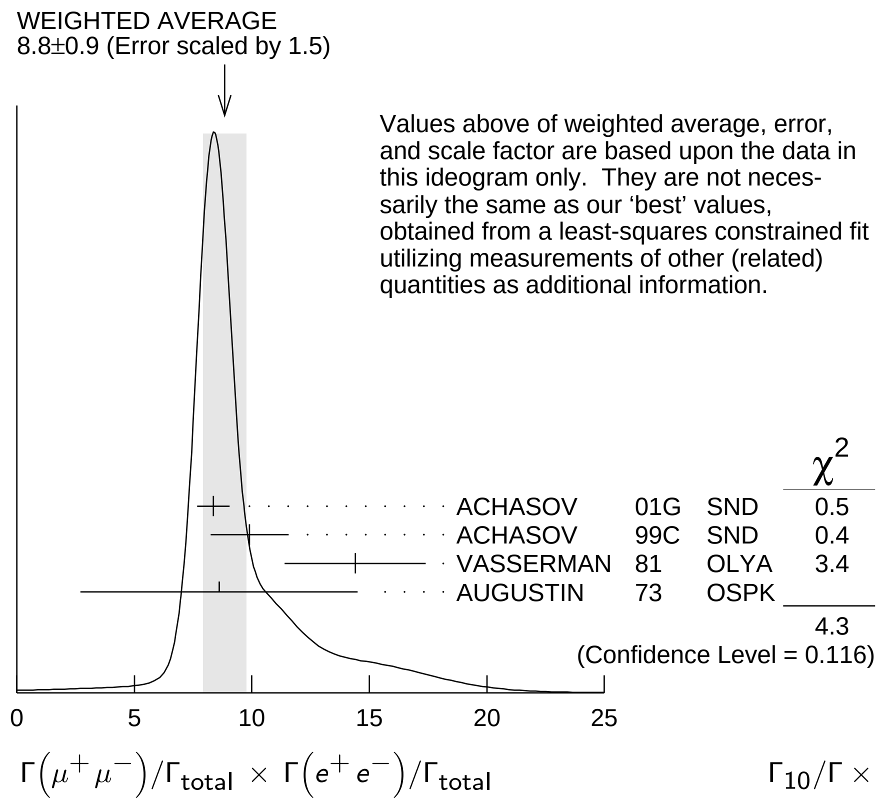
[1] From the VMD model with the interfering $\rho(770)$, $\omega(782)$, $\phi(1020)$ resonances, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 00.
[2] From the $\pi^0 \to 2\gamma$ decay and using B($\pi^0 \to 2\gamma$) = (98.798 ± 0.032) × 10^{-2}.
[3] A simultaneous fit of $e^+e^- \to \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

$\Gamma(\mu^+\mu^-)/\Gamma_{\rm total} \times \Gamma(e^+e^-)/\Gamma_{\rm total}$ $\qquad$ $\Gamma_{10}/\Gamma \times \Gamma_9/\Gamma$

VALUE (units 10^{-8})	*DOCUMENT ID*		*TECN*	*COMMENT*
8.5 $^{+0.5}_{-0.6}$ **OUR FIT**				
8.8 ±0.9 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.				
$8.36\pm0.59\pm0.37$	ACHASOV	01G	SND	$e^+e^- \to \mu^+\mu^-$
$9.9\ \pm1.4\ \pm0.9$	[1] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
$14.4\ \pm3.0$	[2] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
$8.6\ \pm5.9$	[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.



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

VALUE (units 10^{-8})	DOCUMENT ID		TECN	COMMENT
2.2 ±0.4 OUR FIT				
2.2 ±0.4 OUR AVERAGE				
2.1 ±0.3 ±0.3	[1] ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$1.95^{+1.15}_{-0.87}$	[2] GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$6.01^{+3.19}_{-2.51}$	[2] VASSERMAN	81	OLYA	$e^+e^- \to \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.31±0.99	[3] BENAYOUN	13	RVUE	0.4–1.05 e^+e^-

[1] Recalculated by the authors from the cross section in the peak.
[2] Recalculated by us from the cross section in the peak.
[3] 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.

$\Gamma(\omega\pi^0)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{13}/\Gamma \times \Gamma_9/\Gamma$

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($\omega(782) \to \pi^+\pi^-\pi^0$) = (89.3 ± 0.6) × 10^{-2}. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{18}/\Gamma \times \Gamma_9/\Gamma$

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

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

$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_{19}/\Gamma \times \Gamma_9/\Gamma$

VALUE (units 10^{-9})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.2^{+0.8}_{-0.7}$ 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.

$\phi(1020)$ BRANCHING RATIOS

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.492±0.005 OUR FIT Error includes scale factor of 1.3.				
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_SK_L, $\pi^+\pi^-\pi^0$

[1] Combined analysis of the CMD-2 data on $\phi \to K^+K^-$, $K^0_SK^0_L$, $\pi^+\pi^-\pi^0$, $\eta\gamma$ 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}.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.340±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	$e^+e^- \to K^0_LK^0_S$
0.326±0.035		DOLINSKY 91	ND	$e^+e^- \to K^0_LK^0_S$
0.310±0.024		DRUZHININ 84	ND	$e^+e^- \to K^0_LK^0_S$

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

0.336±0.002±0.006		[1] AKHMETSHIN	11	CMD2	1.02 $e^+e^- \rightarrow K^0_S K^0_L$
0.351±0.013	500k	[2] ACHASOV	01E	SND	$e^+e^- \rightarrow K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
0.27 ±0.03	133	KALBFLEISCH	76	HBC	2.18 $K^- p \rightarrow \Lambda K^0_L K^0_S$
0.257±0.030	95	[3] BALAKIN	71	OSPK	$e^+e^- \rightarrow K^0_L K^0_S$
0.40 ±0.04	167	LINDSEY	66	HBC	2.1–2.7 $K^- p \rightarrow \Lambda K^0_L K^0_S$

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

[2] Using B($\phi \rightarrow e^+e^-$)= $(2.93 \pm 0.14) \times 10^{-4}$.

[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
0.690±0.015 OUR FIT	Error includes scale factor of 1.3.				
0.740±0.031 OUR AVERAGE					
0.70 ±0.06	2732	BUKIN	78C	OLYA	$e^+e^- \rightarrow K^0_L K^0_S$
0.82 ±0.08		LOSTY	78	HBC	4.2 $K^- p \rightarrow \phi$hyperon
0.71 ±0.05		LAVEN	77	HBC	10 $K^- p \rightarrow K^+K^-\Lambda$
0.71 ±0.08		LYONS	77	HBC	3–4 $K^- p \rightarrow \Lambda\phi$
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. • • •					
0.638±0.022	2.3M	[1] KOZYREV	18	CMD3	$e^+e^- \rightarrow K^0_L K^0_S$, K^+K^-
0.68 ±0.03		[2] AKHMETSHIN	95	CMD2	$e^+e^- \rightarrow K^0_L K^0_S$, K^+K^-

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

[2] 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
0.408±0.005 OUR FIT	Error includes scale factor of 1.3.				
0.45 ±0.04 OUR AVERAGE					
0.44 ±0.07		[1] LONDON	66	HBC	2.24 $K^- p \rightarrow \Lambda K\overline{K}$
0.48 ±0.07	52	BADIER	65B	HBC	3 $K^- p$
0.40 ±0.10	34	SCHLEIN	63	HBC	1.95 $K^- p \rightarrow \Lambda K\overline{K}$

[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.

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.1524±0.0033 OUR FIT Error includes scale factor of 1.2.					
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
0.310±0.009 OUR FIT Error includes scale factor of 1.2.					
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
0.183±0.005 OUR FIT Error includes scale factor of 1.2.				
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
0.448±0.011 OUR FIT Error includes scale factor of 1.1.					
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_5/Γ

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
≃ 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_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.303±0.025 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 γCu
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 $e^+e^- \to \eta\gamma$
1.36 ±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 [$\Gamma(\phi(1020) \to \eta\gamma)/\Gamma_{total}$] × [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($\phi(1020) \to e^+e^-$) = $(2.973 \pm 0.034) \times 10^{-4}$. 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 ± 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_7/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.30 ±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 ± 0.04) × 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 ± 0.08) × 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_6/Γ_7

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_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.973±0.034 OUR FIT	Error includes scale factor of 1.3.				
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_{10}/Γ

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
2.86±0.19 OUR FIT				
2.5 ±0.4 OUR AVERAGE				
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 do not use the following data for averages, fits, limits, etc. • • •

2.87±0.20±0.14	[2] ACHASOV	01G	SND	$e^+e^- \to \mu^+\mu^-$
3.30±0.45±0.32	[3] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
4.83±1.02	[4] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
2.87±1.98	[4] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$

[1] Neglecting interference between resonance and continuum.
[2] Using B($\phi \to e^+e^-$) = (2.91 ± 0.07) × 10^{-4}.
[3] Using B($\phi \to e^+e^-$)=(2.99 ± 0.08) × 10^{-4}.
[4] Recalculated by us using B($\phi \to e^+e^-$)= (2.99 ± 0.08) × 10^{-4}.

$\Gamma(\eta e^+e^-)/\Gamma_{total}$ Γ_{11}/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_{12}/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_{13}/Γ

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
4.7±0.5 OUR FIT				
$5.2^{+1.3}_{-1.1}$	[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	$e^+e^- \to \pi^0\pi^0\gamma$
$5.5^{+1.6}_{-1.4}\pm0.3$	[2,5] AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
$4.8^{+1.9}_{-1.7}\pm0.8$	[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_{14}/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_{15}/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_{16}/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($\phi(1020) \to f_0(980)\gamma$) is negligible. Supersedes AKHMETSHIN 97C.
[2] For $E_\gamma > 20$ MeV and assuming that B($\phi(1020) \to f_0(980)\gamma$) is negligible.

$\Gamma(f_0(980)\gamma)/\Gamma_{total}$ — Γ_{17}/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	$e^+e^-\to\pi^0\pi^0\gamma$
$2.90\pm0.21\pm1.54$			[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	$e^+e^-\to\pi^0\pi^0\gamma$
$1.93\pm0.46\pm0.50$		27188	[6] AKHMETSHIN 99B	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
$3.05\pm0.25\pm0.72$		268	[7] AKHMETSHIN 99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
1.5 ± 0.5		268	[8] AKHMETSHIN 99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
$3.42\pm0.30\pm0.36$		164	[4] ACHASOV 98I	SND	$e^+e^-\to5\gamma$
<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($\phi\to\eta\gamma$)=$(1.338\pm0.053)\times10^{-2}$.

[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_{17}/Γ_6

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.47^{+0.15}_{-0.16}$ OUR FIT Error includes scale factor of 1.1.				
$2.6\pm0.2\ ^{+0.8}_{-0.3}$	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_{18}/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	$e^+e^-\to\pi^0\pi^0\gamma$
$1.08\pm0.17\pm0.09$		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_{18}/Γ_6

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_{19}/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_{20}/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	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-\pi^0$

$\Gamma(\pi^0e^+e^-)/\Gamma_{total}$ — Γ_{21}/Γ

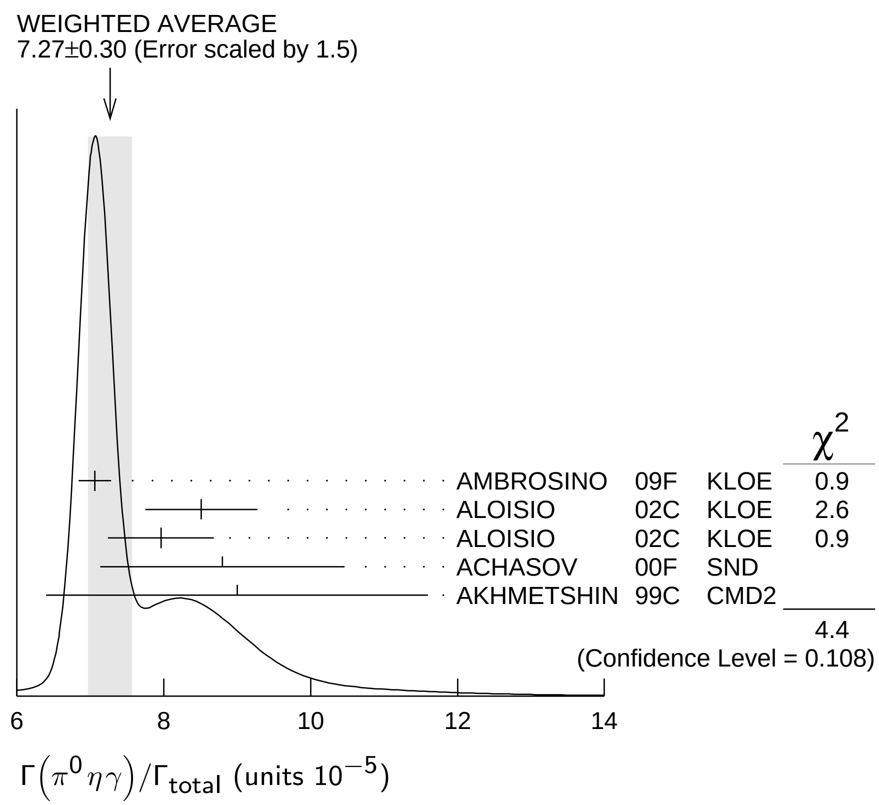
VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$1.33^{+0.07}_{-0.10}$ OUR AVERAGE						
$1.35\pm0.05^{+0.05}_{-0.10}$		9.5k	[1] ANASTASI	16B	KLOE	$e^+e^- \to \pi^0e^+e^-$
1.01±0.28±0.29		52	[2] ACHASOV	02D	SND	$e^+e^- \to \pi^0e^+e^-$
1.22±0.34±0.21		46	[3] AKHMETSHIN	01C	CMD2	$e^+e^- \to \pi^0e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<12	90		DOLINSKY	88	ND	$e^+e^- \to \pi^0e^+e^-$

[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 ± 0.00032, B($\phi \to \eta\gamma$) = (1.297 ± 0.033) × 10^{-2}, and B($\eta \to \pi^+\pi^-\gamma$) = (4.75 ± 0.11) × 10^{-2}.

$\Gamma(\pi^0\eta\gamma)/\Gamma_{total}$ — Γ_{22}/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±0.51±0.57		607	[2] ALOISIO 02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
7.96±0.60±0.40		197	[3] ALOISIO 02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
8.8 ±1.4 ±0.9		36	[4] ACHASOV 00F	SND	$e^+e^- \to \eta\pi^0\gamma$
9.0 ±2.4 ±1.0		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±0.10±0.20		13.3k	[2,5] AMBROSINO 09F	KLOE	1.02 $e^+e^- \to \eta\pi^0\gamma$
7.12±0.13±0.22		3.6k	[3,6] AMBROSINO 09F	KLOE	1.02 $e^+e^- \to \eta\pi^0\gamma$
8.3 ±2.3 ±1.2		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 ± 0.025)%, B($\eta \to 3\pi^0$) = (32.56 ± 0.23)%, and B($\eta \to \gamma\gamma$) = (39.31 ± 0.20)%.
[6] Using B($\phi \to \eta\gamma$) = (1.304 ± 0.025)%, B($\eta \to 3\pi^0$) = (32.56 ± 0.23)%, and B($\eta \to \pi^+\pi^-\pi^0$) = (22.73 ± 0.28)%.



$\Gamma(a_0(980)\gamma)/\Gamma_{total}$ — Γ_{23}/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_{17}/Γ_{23}

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_{24}/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_{25}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
6.22±0.21 OUR FIT						
6.22±0.30 OUR AVERAGE						
6.22±0.27±0.12		3407	[1] AMBROSINO	07A	KLOE	1.02 $e^+e^- \to \pi^+\pi^-7\gamma$
6.7 $^{+2.8}_{-2.4}$ ±0.8		12	[2] AULCHENKO	03B	SND	$e^+e^- \to \eta'\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
6.7 $^{+5.0}_{-4.2}$ ±1.5		7	AULCHENKO	03B	SND	$e^+e^- \to 7\gamma$
6.10±0.61±0.43		120	[3] ALOISIO	02E	KLOE	1.02 $e^+e^- \to \pi^+\pi^-3\gamma$
8.2 $^{+2.1}_{-1.9}$ ±1.1		21	[4] AKHMETSHIN	00B	CMD2	$e^+e^- \to \pi^+\pi^-3\gamma$
4.9 $^{+2.2}_{-1.8}$ ±0.6		9	[5] AKHMETSHIN	00F	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
6.4 ±1.6		30	[6] AKHMETSHIN	00F	CMD2	$e^+e^- \to \eta'(958)\gamma$
6.7 $^{+3.4}_{-2.9}$ ±1.0		5	[7] AULCHENKO	99	SND	$e^+e^- \to \pi^+\pi^-3\gamma$
<11	90		AULCHENKO	98	SND	$e^+e^- \to 7\gamma$
12 $^{+7}_{-5}$ ±2		6	[4] AKHMETSHIN	97B	CMD2	$e^+e^- \to \pi^+\pi^- 3\gamma$
<41	90		DRUZHININ	87	ND	$e^+e^- \to \gamma\eta\pi^+\pi^-$

[1] AMBROSINO 07A reports $[\Gamma(\phi(1020) \to \eta'(958)\gamma)/\Gamma_{total}]$ / $[B(\phi(1020) \to \eta\gamma)]$ = $(4.77 \pm 0.09 \pm 0.19) \times 10^{-3}$ which we multiply by our best value $B(\phi(1020) \to \eta\gamma)$ =

$(1.303 \pm 0.025) \times 10^{-2}$. 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($\phi \to \eta\gamma$)= (1.297 ± 0.033)%.

[4] Using the value B($\phi \to \eta\gamma$) = $(1.26 \pm 0.06) \times 10^{-2}$.

[5] Using B($\phi \to K^0_L K^0_S$) = (33.8 ± 0.6)%.

[6] Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.

[7] Using the value B($\eta' \to \eta\pi^+\pi^-$)= $(43.7 \pm 1.5) \times 10^{-2}$ and B($\eta \to \gamma\gamma$)= $(39.25 \pm 0.31) \times 10^{-2}$.

$\Gamma(\eta'(958)\gamma)/\Gamma(K^0_L K^0_S)$ — Γ_{25}/Γ_2

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.83±0.06 OUR FIT				
$1.46^{+0.64}_{-0.54}\pm0.18$	9	[1] AKHMETSHIN 00F	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$

[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_{25}/Γ_6

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 $e^+e^- \to \pi^+\pi^-7\gamma$
4.70±0.47±0.31	120	[1] ALOISIO 02E	KLOE	1.02 $e^+e^- \to \pi^+\pi^-3\gamma$
$6.5^{+1.7}_{-1.5}\pm0.8$	21	AKHMETSHIN 00B	CMD2	$e^+e^- \to \pi^+\pi^-3\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$9.5^{+5.2}_{-4.0}\pm1.4$	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_{26}/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_{27}/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_{28}/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_{29}/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_{30}/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_{31}/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_{32}/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_{33}/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 $\phi \to P e^+ e^-$ DECAYS

In the one-pole approximation the electromagnetic transition form factor for $\phi \to P e^+ e^-$ ($P = \pi,\eta$) 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 $\phi \to \pi^0 e^+ e^-$ DECAY

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

[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					
$1.28 \pm 0.10^{+0.09}_{-0.08}$	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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