$\phi(1020)$

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

$\phi(1020)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1019.455±0.020 OUR AVERAGE		Error includes scale factor of 1.1.			
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	[1] AKHMETSHIN	04	CMD2	$e^+e^- \to K_L^0 K_S^0$
1019.42 ±0.05	1900k	[2] 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		[3] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$
1019.38 ±0.07 ±0.08	2200	[4] 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 $\to 4K$X
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	[5] 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. • • •					
1019.63 ±0.07	12540	[6] 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	[6] ATKINSON	86	OMEG	20–70 γp
1019.7 ±1.0		BEBEK	86	CLEO	$e^+e^- \to \Upsilon(4S)$
1019.411±0.008	642k	[7] DIJKSTRA	86	SPEC	100–200 $\pi^\pm$, $\overline{p}$, p, $K^\pm$, on Be
1020.9 ±0.2		[6] FRAME	86	OMEG	13 $K^+p \to \phi K^+p$
1021.0 ±0.2		[6] ARMSTRONG	83B	OMEG	18.5 $K^-p \to K^-K^+\Lambda$
1020.0 ±0.5		[6] ARMSTRONG	83B	OMEG	18.5 $K^-p \to K^-K^+\Lambda$
1019.7 ±0.3		[6] 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 $\overline{p}p \to K_S^0 K_L^0 \pi^+\pi^-$
1020 ±1	383	[6] 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 $K^- p \rightarrow \Lambda K \overline{K}$
1019.4	±0.8	984		BESCH	74	CNTR	2 $\gamma p \rightarrow p K^+ K^-$
1020.3	±0.4	100		BALLAM	73	HBC	2.8–9.3 γp
1019.4	±0.7			BINNIE	73B	CNTR	$\pi^- p \rightarrow \phi n$
1019.6	±0.5	120	[8]	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \rightarrow \Lambda K^+ K^-$
1019.9	±0.5	100	[8]	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \rightarrow K^- p K^+ K^-$
1020.4	±0.5	131		COLLEY	72	HBC	10 $K^+ p \rightarrow K^+ p \phi$
1019.9	±0.3	410		STOTTLE...	71	HBC	2.9 $K^- p \rightarrow \Sigma / \Lambda K \overline{K}$

[1] Update of AKHMETSHIN 01D

[2] 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.

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

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

[5] PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DE-GROOT 74.

[6] Systematic errors not evaluated.

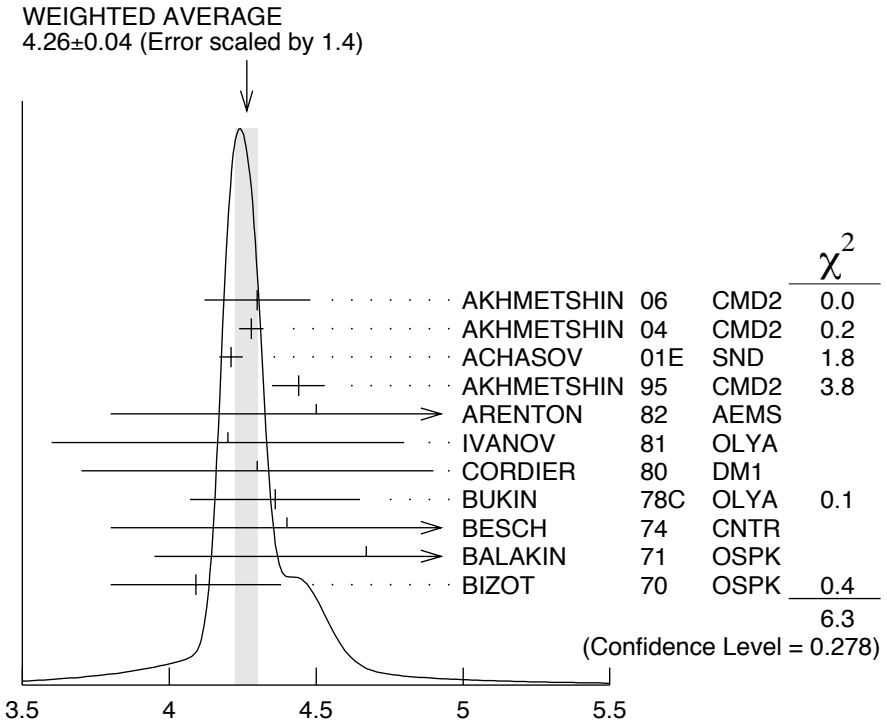
[7] Weighted and scaled average of 12 measurements of DIJKSTRA 86.

[8] 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*
4.26 ±0.04 OUR AVERAGE			Error includes scale factor of 1.4.			See the ideogram below.
4.30 ±0.06	±0.17	105k	AKHMETSHIN	06	CMD2	0.98–1.06 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
4.280 ±0.033	±0.025	272k	[9] AKHMETSHIN	04	CMD2	$e^+ e^- \rightarrow K_L^0 K_S^0$
4.21 ±0.04		1900k	[10] 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	[11] IVANOV	81	OLYA	1–1.4 $e^+ e^- \rightarrow K^+ K^-$
4.3 ±0.6			[11] CORDIER	80	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
4.36 ±0.29		3681	[11] BUKIN	78C	OLYA	$e^+ e^- \rightarrow$ hadrons
4.4 ±0.6		984	[11] BESCH	74	CNTR	2 $\gamma p \rightarrow p K^+ K^-$
4.67 ±0.72		681	[11] 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. • • •						
4.28 ±0.13		12540	[12] 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	[11] COOPER	78B	HBC	0.7–0.8 $\overline{p} p \rightarrow K_S^0 K_L^0 \pi^+ \pi^-$
4.5 ±0.50		1300	[11,12] AKERLOF	77	SPEC	400 pA $\rightarrow K^+ K^-$ X

4.5	±0.8	500	[11,12]	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	[11]	BORENSTEIN	72	HBC	2.18 $K^- p \rightarrow K \overline{K} n$



$\phi(1020)$ width (MeV)

[9] Update of AKHMETSHIN 01D

[10] 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.

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

[12] Systematic errors not evaluated.

ϕ(1020) DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$K^+ K^-$	(49.3 ±0.6) %	S=1.2
Γ_2	$K^0_L K^0_S$	(34.0 ±0.5) %	S=1.1
Γ_3	$\rho\pi + \pi^+\pi^-\pi^0$	(15.23 ±0.35) %	S=1.2
Γ_4	$\rho\pi$		
Γ_5	$\pi^+\pi^-\pi^0$		
Γ_6	$\eta\gamma$	(1.305±0.025) %	S=1.2
Γ_7	$\pi^0\gamma$	(1.24 ±0.07) $\times 10^{-3}$	
Γ_8	$\ell^+\ell^-$		

Γ_9	$e^+ e^-$	$(2.98 \pm 0.04) \times 10^{-4}$		S=1.1
Γ_{10}	$\mu^+ \mu^-$	$(2.85 \pm 0.19) \times 10^{-4}$		
Γ_{11}	$\eta e^+ e^-$	$(1.15 \pm 0.10) \times 10^{-4}$		
Γ_{12}	$\pi^+ \pi^-$	$(7.3 \pm 1.3) \times 10^{-5}$		
Γ_{13}	$\omega \pi^0$	$(5.2 \, {}^{+1.3}_{-1.1}) \times 10^{-5}$		
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}	$f_0(980) \gamma$	$(1.11 \pm 0.07) \times 10^{-4}$		
Γ_{18}	$\pi^0 \pi^0 \gamma$	$(1.09 \pm 0.06) \times 10^{-4}$		
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}	$\pi^0 e^+ e^-$	$(1.12 \pm 0.28) \times 10^{-5}$		
Γ_{22}	$\pi^0 \eta \gamma$	$(8.3 \pm 0.5) \times 10^{-5}$		
Γ_{23}	$a_0(980) \gamma$	$(7.6 \pm 0.6) \times 10^{-5}$		
Γ_{24}	$\eta'(958) \gamma$	$(6.23 \pm 0.21) \times 10^{-5}$		
Γ_{25}	$\eta \pi^0 \pi^0 \gamma$	< 2	$\times 10^{-5}$	CL=90%
Γ_{26}	$\mu^+ \mu^- \gamma$	$(1.4 \pm 0.5) \times 10^{-5}$		
Γ_{27}	$\rho \gamma \gamma$	< 5	$\times 10^{-4}$	CL=90%
Γ_{28}	$\eta \pi^+ \pi^-$	< 1.8	$\times 10^{-5}$	CL=90%
Γ_{29}	$\eta \mu^+ \mu^-$	< 9.4	$\times 10^{-6}$	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to 25 branching ratios uses 72 measurements and one constraint to determine 12 parameters. The overall fit has a $\chi^2 = 82.4$ for 61 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	−80									
x_3	−62	3								
x_6	−28	21	13							
x_7	−14	11	7	10						
x_9	59	−50	−31	−43	−23					
x_{10}	−9	7	4	6	3	−14				
x_{12}	−4	3	2	3	2	−7	1			
x_{17}	0	0	0	0	0	0	0	0		
x_{19}	−1	1	1	1	0	−2	0	0	0	
x_{23}	0	0	0	0	0	0	0	0	0	0
x_{24}	−9	7	4	33	3	−14	2	1	0	0
	x_1	x_2	x_3	x_6	x_7	x_9	x_{10}	x_{12}	x_{17}	x_{19}

x_{24}	0
	x_{23}

$\phi(1020)$ 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. • • •				
$58.9 \pm 0.5 \pm 2.4$	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. • • •				
$5.40 \pm 0.16 ^{+0.43}_{-0.40}$	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. • • •				
$1.320 \pm 0.017 \pm 0.015$	[13] AMBROSINO	05	KLOE	1.02 $e^+e^- \to \mu^+\mu^-$

$\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.27±0.04 OUR EVALUATION					
1.32±0.05±0.03		[14] AMBROSINO	05	KLOE	1.02 $e^+e^- \to e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.27±0.03	272k	[15] AKHMETSHIN	04	CMD2	$e^+e^- \to K_L^0 K_S^0$

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

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

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

[14] From forward-backward asymmetry and using $\Gamma_{\rm total} = 4.26 \pm 0.05$ MeV from the 2004 edition of this Review.

[15] Using $B(\phi \to K_L^0 K_S^0) = 0.337 \pm 0.005$ and $\Gamma_{\rm total} = 4.26 \pm 0.05$ MeV. Update of AKHMETSHIN 99D.

$\phi(1020)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\rm total)$

$\Gamma(e^+e^-) \times \Gamma(K^+K^-)/\Gamma^2_{\rm total}$ $\Gamma_9\Gamma_1/\Gamma^2$

VALUE (units 10^{-5})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
14.67±0.33 OUR FIT	Error includes scale factor of 1.2.				
13.93±0.14±0.99	1000k	[16] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$

$\Gamma(e^+e^-) \times \Gamma(K_L^0K_S^0)/\Gamma^2_{\rm total}$ $\Gamma_9\Gamma_2/\Gamma^2$

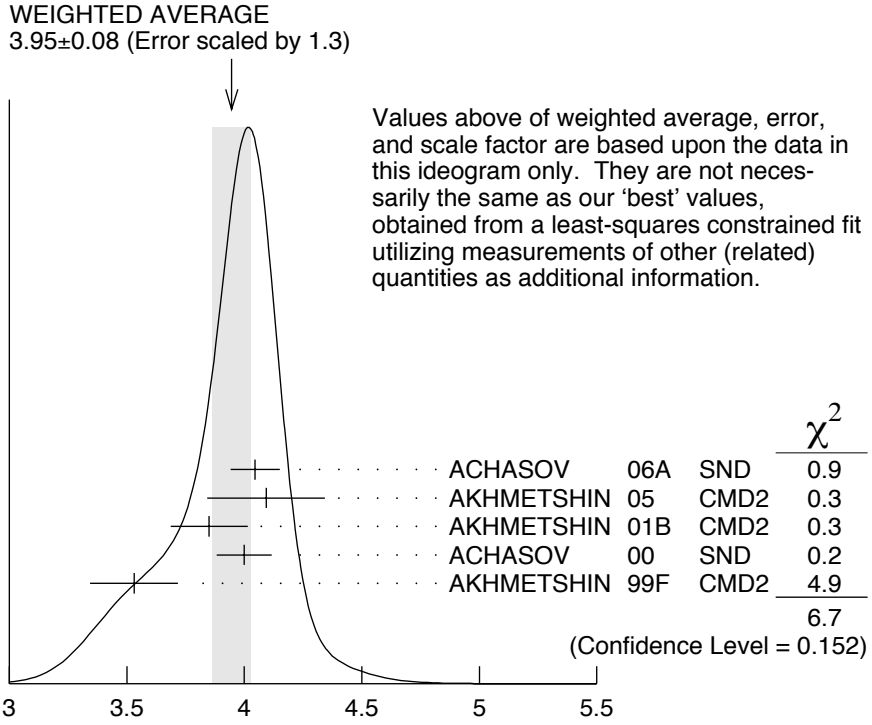
VALUE (units 10^{-5})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
10.12±0.13 OUR FIT					
10.06±0.16 OUR AVERAGE					
10.01±0.04±0.17	272k	[17] AKHMETSHIN	04	CMD2	$e^+e^- \to K_L^0K_S^0$
10.27±0.07±0.34	500k	[16] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$

$\Gamma(e^+e^-) \times [\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)]/\Gamma^2_{\rm total}$ $\Gamma_9\Gamma_3/\Gamma^2$

VALUE (units 10^{-5})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.54 ±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	[16] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$
4.35 ±0.27 ±0.08	11169	[18] AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_6/\Gamma^2$

VALUE (units 10^{-6})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3.89 ±0.07 OUR FIT	Error includes scale factor of 1.2.				
3.95 ±0.08 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
$4.046 \pm 0.056 \pm 0.089$	33k	[19] ACHASOV	06A	SND	$e^+e^- \to \eta\gamma$
$4.093 \,^{+0.040}_{-0.043} \pm 0.247$	17.4k	[20] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
$3.850 \pm 0.041 \pm 0.159$	23k	[21,22] AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
$4.00 \pm 0.04 \pm 0.11$		[23] ACHASOV	00	SND	$e^+e^- \to \eta\gamma$
$3.53 \pm 0.08 \pm 0.17$	2200	[24,25] AKHMETSHIN	99F	CMD2	$e^+e^- \to \eta\gamma$



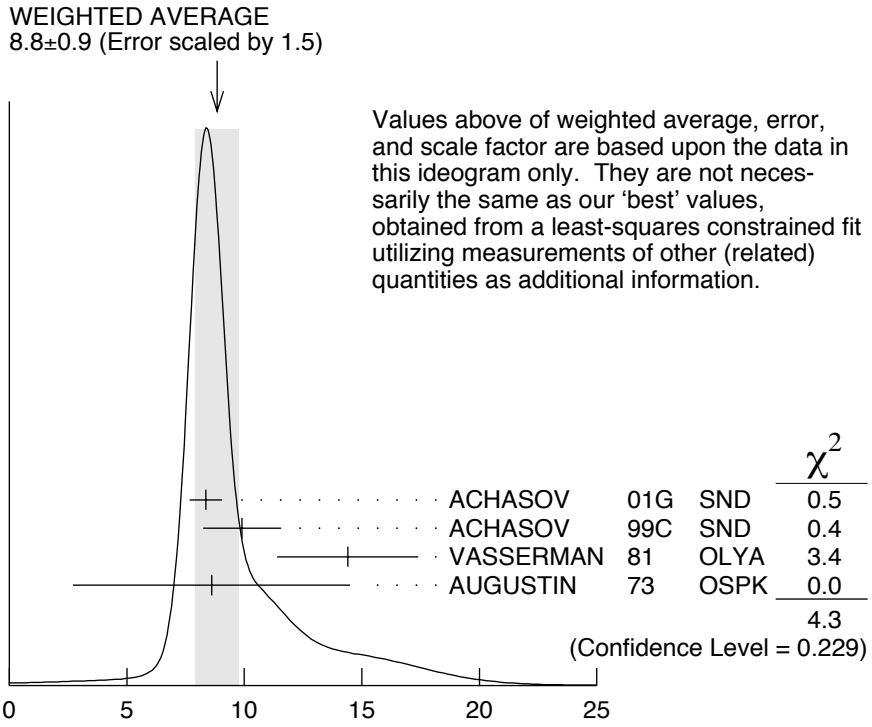
$\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_6/\Gamma^2$

$\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_7/\Gamma^2$

VALUE (units 10^{-7})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3.71±0.21 OUR FIT					
3.71±0.21 OUR AVERAGE					
$3.75 \pm 0.11 \pm 0.29$	18680	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
$3.67 \pm 0.10 \,^{+0.27}_{-0.25}$		[26] ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$

$\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_{10}/\Gamma^2$

VALUE (units 10^{-8})	*DOCUMENT ID*		*TECN*	*COMMENT*
8.5 ±0.6 OUR FIT				
8.8 ±0.9 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.			
$8.36 \pm 0.59 \pm 0.37$	ACHASOV	01G	SND	$e^+e^- \to \mu^+\mu^-$
9.9 ±1.4 ±0.9	[24] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
14.4 ±3.0	[18] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
8.6 ±5.9	[18] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$



$\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_{10}/\Gamma^2$

$\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_{12}/\Gamma^2$

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	[24] ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$1.95^{+1.15}_{-0.87}$	[18] GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$6.01^{+3.19}_{-2.51}$	[18] VASSERMAN	81	OLYA	$e^+e^- \to \pi^+\pi^-$

$\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma^2_{\text{total}}$ $\Gamma_9\Gamma_{19}/\Gamma^2$

VALUE (units 10^{-9})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$1.2\ ^{+0.8}_{-0.7}$ OUR FIT					
1.17±0.52±0.64	3285	[24] AKHMETSHIN	00E	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-$

[16] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^-, K_SK_L, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.
[17] Update of AKHMETSHIN 01D
[18] Recalculated by us from the cross section in the peak.
[19] 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 $B(\eta \to 3\pi^0)/B(\eta \to \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Supersedes ACHASOV 00D and ACHASOV 00B. Recalculated by us from the cross section at the peak.
[20] From the $\eta \to 2\gamma$ decay and using $B(\eta \to \gamma\gamma) = 39.43 \pm 0.26\%$.
[21] From the $\eta \to 3\pi^0$ decay and using $B(\eta \to 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
[22] 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).
[23] From the $\eta \to 2\gamma$ decay and using $B(\eta \to 2\gamma) = (39.21 \pm 0.34) \times 10^{-2}$.
[24] Recalculated by the authors from the cross section in the peak.
[25] From the $\eta \to \pi^+\pi^-\pi^0$ decay and using $B(\eta \to \pi^+\pi^-\pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.
[26] From the $\pi^0 \to 2\gamma$ decay and using $B(\pi^0 \to 2\gamma) = (98.798 \pm 0.032) \times 10^{-2}$.

$\phi(1020)$ BRANCHING RATIOS

$\Gamma(K^+K^-)/\Gamma_{total}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.493±0.006 OUR FIT	Error includes scale factor of 1.2.				
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. • • •					
0.476±0.017	1000k	[27] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.340±0.005 OUR FIT	Error includes scale factor of 1.1.				
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. • • •					
0.351±0.013	500k	[27] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$
0.27 ±0.03	133	KALBFLEISCH	76	HBC	2.18 $K^-p \to \Lambda K^0_LK^0_S$
0.257±0.030	95	BALAKIN	71	OSPK	$e^+e^- \to K^0_LK^0_S$
0.40 ±0.04	167	LINDSEY	66	HBC	2.1–2.7 $K^-p \to \Lambda K^0_LK^0_S$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.1523±0.0035 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. • • •					
0.159 ±0.008	400k	[27] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$
0.145 ±0.009 ±0.003	11169	[28] AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
0.139 ±0.007		[29] PARROUR	76B	OSPK	e^+e^-

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.408±0.006 OUR FIT Error includes scale factor of 1.1.					
0.45 ±0.04 OUR AVERAGE					
0.44 ±0.07		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 $K^-p \to \Lambda K\overline{K}$

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.183±0.005 OUR FIT Error includes scale factor of 1.1.				
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 $K^-p \to \Lambda\pi^+\pi^-\pi^0$

$[\Gamma(\rho\pi)+\Gamma(\pi^+\pi^-\pi^0)]/\Gamma(K^0_LK^0_S)$ Γ_3/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.448±0.012 OUR FIT Error includes scale factor of 1.1.					
0.51 ±0.05 OUR AVERAGE					
0.56 ±0.07	3681	BUKIN	78C	OLYA	$e^+e^- \to K^0_LK^0_S$, $\pi^+\pi^-\pi^0$
0.47 ±0.06	516	COSME	74	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma(\eta\gamma)/\Gamma(\pi^0\gamma)$ Γ_6/Γ_7

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$10.9\pm0.3^{+0.7}_{-0.8}$	ACHASOV	00	SND	$e^+e^- \to \eta\gamma$, $\pi^0\gamma$

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

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
2.85±0.19 OUR FIT				
2.5 ±0.4 OUR AVERAGE				
2.69±0.46	[30] HAYES	71	CNTR	8.3,9.8 γC $\to \mu^+\mu^-$X
2.17±0.60	[30] EARLES	70	CNTR	6.0 γC $\to \mu^+\mu^-$X

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

2.87±0.20±0.14	[31] ACHASOV	01G	SND	$e^+e^- \to \mu^+\mu^-$
3.30±0.45±0.32	[28] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
4.83±1.02	[32] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
2.87±1.98	[32] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$

$\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.305±0.025 OUR FIT	Error includes scale factor of 1.2.				
1.26 ±0.04 OUR AVERAGE					
1.246±0.025±0.057	10k	[33] ACHASOV	98F	SND	$e^+e^- \to 7\gamma$
1.18 ±0.11	279	[34] AKHMETSHIN	95	CMD2	$e^+e^- \to \pi^+\pi^-3\gamma$
1.30 ±0.06		[35] DRUZHININ	84	ND	$e^+e^- \to 3\gamma$
1.4 ±0.2		[36] 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	[35] COSME	76	OSPK	e^+e^-

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

1.362±0.019±0.035	33k	[37] ACHASOV	06A	SND	$e^+e^- \to \eta\gamma$
1.373±0.014±0.085	17.4k	[38,39] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
1.287±0.013±0.063		[40,41] AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
1.338±0.012±0.052		[42] ACHASOV	00	SND	$e^+e^- \to \eta\gamma$
1.18 ±0.03 ±0.06	2200	[43] AKHMETSHIN	99F	CMD2	$e^+e^- \to \eta\gamma$
1.21 ±0.07		[44] BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \to \eta\gamma$

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

VALUE (units 10^{-4})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.41±0.12±0.04		30175	[45] AKHMETSHIN	99B	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$

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

< 0.3	90	[46] 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

$\Gamma(\omega\gamma)/\Gamma_{\text{total}}$ 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

$\Gamma(\rho\gamma)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
< 0.12	90	[47] 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

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.98±0.04 OUR FIT Error includes scale factor of 1.1.					
2.98±0.07 OUR AVERAGE Error includes scale factor of 1.1.					
2.93±0.14	1900k	[48] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_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		[49] 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^-

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
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. • • •					
$1.258\pm0.037\pm0.077$	18680	[50,51] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
$1.226\pm0.036^{+0.096}_{-0.089}$		[52] ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$
1.26 ±0.17		[44] BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \to \pi^0\gamma$

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.71\pm0.11\pm0.09$		[28] ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$0.65^{+0.38}_{-0.29}$		[28] GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$2.01^{+1.07}_{-0.84}$		[28] 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 $\gamma C \to C\pi^+\pi^-$

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

VALUE (units 10^{-5})		*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{5.2^{+1.3}_{-1.1}}$	[53,54]	AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 5.4	[55]	ACHASOV	00E	SND	$e^+e^- \to \pi^0\pi^0\gamma$
$5.5^{+1.6}_{-1.4}\pm0.3$	[54,56]	AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
$4.8^{+1.9}_{-1.7}\pm0.8$	[55]	ACHASOV	99	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$

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

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.690±0.017 OUR FIT Error includes scale factor of 1.1.					
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 $K^-p \to$ ϕhyperon
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. • • •					
0.68 ±0.03		[57] AKHMETSHIN	95	CMD2	$e^+e^- \to K^0_L K^0_S$, K^+K^-

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

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.309±0.010 OUR FIT Error includes scale factor of 1.2.					
0.28 ±0.09	34	AGUILAR-...	72B	HBC	3.9,4.6 K^-p

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

VALUE (units 10^{-4})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.15±0.10 OUR AVERAGE					
1.19±0.19±0.12	213	[58] ACHASOV	01B	SND	$e^+e^- \to \gamma\gamma e^+e^-$
1.14±0.10±0.06	355	[59] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
$1.3\ ^{+0.8}_{-0.6}$	7	GOLUBEV	85	ND	$e^+e^- \to \gamma\gamma e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.13±0.14±0.07	183	[60] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
1.21±0.14±0.09	130	[61] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
1.04±0.20±0.08	42	[62] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$

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

VALUE (units 10^{-5})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
6.23±0.21 OUR FIT						
6.23±0.30 OUR AVERAGE						
6.23±0.27±0.12		3407	[63] AMBROSINO	07A	KLOE	1.02 $e^+e^- \to \pi^+\pi^-7\gamma$
$6.7\ ^{+2.8}_{-2.4}\ \pm0.8$		12	[64] AULCHENKO	03B	SND	$e^+e^- \to \eta'\gamma$

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

$6.7\ ^{+5.0}_{-4.2}\ \pm1.5$		7		AULCHENKO	03B	SND	$e^+e^- \to 7\gamma$
$6.10\pm0.61\pm0.43$		120	[65]	ALOISIO	02E	KLOE	$1.02\ e^+e^- \to \pi^+\pi^-3\gamma$
$8.2\ ^{+2.1}_{-1.9}\ \pm1.1$		21	[66]	AKHMETSHIN	00B	CMD2	$e^+e^- \to \pi^+\pi^-3\gamma$
$4.9\ ^{+2.2}_{-1.8}\ \pm0.6$		9	[67]	AKHMETSHIN	00F	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
$6.4\ \pm1.6$		30	[68]	AKHMETSHIN	00F	CMD2	$e^+e^- \to \eta'(958)\gamma$
$6.7\ ^{+3.4}_{-2.9}\ \pm1.0$		5	[69]	AULCHENKO	99	SND	$e^+e^- \to \pi^+\pi^-3\gamma$
<11	90			AULCHENKO	98	SND	$e^+e^- \to 7\gamma$
$12\ ^{+7}_{-5}\ \pm2$		6	[66]	AKHMETSHIN	97B	CMD2	$e^+e^- \to \pi^+\pi^-\ 3\gamma$
<41	90			DRUZHININ	87	ND	$e^+e^- \to \gamma\eta\pi^+\pi^-$

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

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

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

VALUE (units 10^{-4})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.09 ±0.06 OUR AVERAGE						
$1.09\ \pm0.03\ \pm0.05$		2438	ALOISIO	02D	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. • • •

$1.158\pm0.093\pm0.052$		419	[70,71]	ACHASOV	00H	SND	$e^+e^- \to \pi^0\pi^0\gamma$
<10	90			DRUZHININ	87	ND	$e^+e^- \to 5\gamma$

$\Gamma(\pi^0\pi^0\gamma)/\Gamma(\eta\gamma)$ Γ_{18}/Γ_6

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.865±0.070±0.017	419	[71] ACHASOV	00H	SND	$e^+e^- \to \pi^0\pi^0\gamma$

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

$0.90\ \pm0.08\ \pm0.07$	164	ACHASOV	98I	SND	$e^+e^- \to 5\gamma$

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

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

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$3.93\pm1.74\pm2.14$		3285	AKHMETSHIN	00E	CMD2	$e^+e^-\to\pi^+\pi^-\pi^+\pi^-$
<870	90		CORDIER	79	WIRE	$e^+e^-\to\pi^+\pi^-\pi^+\pi^-$

$\Gamma(f_0(980)\gamma)/\Gamma_{total}$ Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.11 ± 0.07 OUR FIT						
1.07 ± 0.06 OUR AVERAGE						
$1.07^{+0.01}_{-0.03}{}^{+0.06}_{-0.06}$			[72] AMBROSINO	07	KLOE	$1.02\ e^+e^-\to\pi^0\pi^0\gamma$
$2.90\pm0.21\pm1.54$			[73] 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	[74] ALOISIO	02D	KLOE	$e^+e^-\to\pi^0\pi^0\gamma$
$3.5\ \pm0.3\ ^{+1.3}_{-0.5}$		419	[70,75] ACHASOV	00H	SND	$e^+e^-\to\pi^0\pi^0\gamma$
$1.93\pm0.46\pm0.50$		27188	[76] AKHMETSHIN	99B	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
$3.05\pm0.25\pm0.72$		268	[77] AKHMETSHIN	99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
$1.5\ \pm0.5$		268	[78] AKHMETSHIN	99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
$3.42\pm0.30\pm0.36$		164	[75] ACHASOV	98I	SND	$e^+e^-\to5\gamma$
<1	90		[79] AKHMETSHIN	97C	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
<7	90		[80] AKHMETSHIN	97C	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
<20	90		DRUZHININ	87	ND	$e^+e^-\to\pi^0\pi^0\gamma$

$\Gamma(f_0(980)\gamma)/\Gamma(\eta\gamma)$ Γ_{17}/Γ_6

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.85 ± 0.05 OUR FIT Error includes scale factor of 1.1.					
$2.6\ \pm0.2\ ^{+0.8}_{-0.3}$	419	[75] ACHASOV	00H	SND	$e^+e^-\to\pi^0\pi^0\gamma$

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.12 ± 0.28 OUR AVERAGE						
$1.01\pm0.28\pm0.29$		52	[81] ACHASOV	02D	SND	$e^+e^-\to\pi^0e^+e^-$
$1.22\pm0.34\pm0.21$		46	[82] 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	$e^+e^-\to\pi^0e^+e^-$

$\Gamma(\pi^0\eta\gamma)/\Gamma_{total}$ Γ_{22}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$8.3\ \pm0.5$ OUR AVERAGE						
$8.51\pm0.51\pm0.57$		607	[83] ALOISIO	02C	KLOE	$e^+e^-\to\eta\pi^0\gamma$
$7.96\pm0.60\pm0.40$		197	[84] ALOISIO	02C	KLOE	$e^+e^-\to\eta\pi^0\gamma$
$8.8\ \pm1.4\ \pm0.9$		36	[85] 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. • • •						

8.3 ±2.3 ±1.2		20	ACHASOV	98B	SND	$e^+e^- \to 5\gamma$
<250	90		DOLINSKY	91	ND	$e^+e^- \to \pi^0\eta\gamma$

$\Gamma(a_0(980)\gamma)/\Gamma_{total}$ 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			[86] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
8.8±1.7		36	[87] ACHASOV	00F	SND	$e^+e^- \to \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
11 ±2			[88] GOKALP	02	RVUE	$e^+e^- \to \eta\pi^0\gamma$
<500	90		DOLINSKY	91	ND	$e^+e^- \to \pi^0\eta\gamma$

$\Gamma(f_0(980)\gamma)/\Gamma(a_0(980)\gamma)$ Γ_{17}/Γ_{23}

VALUE	DOCUMENT ID		TECN	COMMENT
6.1±0.6	[89] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$

$\Gamma(\eta'(958)\gamma)/\Gamma(K_L^0K_S^0)$ Γ_{24}/Γ_2

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.83±0.06 OUR FIT					
$\mathbf{1.46^{+0.64}_{-0.54}\pm0.18}$	9	[90] AKHMETSHIN	00F	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$

$\Gamma(\eta'(958)\gamma)/\Gamma(\eta\gamma)$ Γ_{24}/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	[91] 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	[92] AKHMETSHIN	97B	CMD2	$e^+e^- \to \pi^+\pi^-\ 3\gamma$

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
1.43±0.45±0.14	27188	[76] 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	[93] AKHMETSHIN	97C	CMD2	$e^+e^- \to \mu^+\mu^-\gamma$

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<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. • • •

<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	$e^+e^- \to \eta e^+e^-$

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ Γ_5/Γ

VALUE	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$\simeq 0.0087$		1.98M [94,95]	ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
<0.0006	90	[96]	ACHASOV	02	SND	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
<0.23	90	[96]	CORDIER	80	DM1	$e^+e^- \to \pi^+\pi^-\pi^0$
<0.20	90	[96]	PARROUR	76B	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$

[27] Using $B(\phi \to e^+e^-) = (2.93 \pm 0.14) \times 10^{-4}$.
[28] Using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[29] Using $\Gamma(\phi) = 4.1$ 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.
[30] Neglecting interference between resonance and continuum.
[31] Using $B(\phi \to e^+e^-) = (2.91 \pm 0.07) \times 10^{-4}$.
[32] Recalculated by us using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[33] Using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \to 3\pi^0) = (32.2 \pm 0.4) \times 10^{-2}$.
[34] From $\pi^+\pi^-\pi^0$ decay mode of η.
[35] From 2γ decay mode of η.
[36] From $3\pi^0$ decay mode of η.
[37] Using $B(\phi \to e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$.
[38] Using $B(\phi \to e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$ and $B(\eta \to \gamma\gamma) = 39.43 \pm 0.26\%$.
[39] Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma^2_{total}$.
[40] Using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \to 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
[41] 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).
[42] From the $\eta \to 2\gamma$ decay and using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[43] From $\pi^+\pi^-\pi^0$ decay mode of η and using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[44] Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.
[45] For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \to f_0(980)\gamma)$ is negligible. Supersedes AKHMETSHIN 97C.
[46] For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \to f_0(980)\gamma)$ is negligible.
[47] Supersedes AKHMETSHIN 97C.
[48] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^-, K_SK_L, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.
[49] 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.

[50] Using $B(\phi \to e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$.
[51] Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma^2_{\text{total}}$.
[52] From the $\pi^0 \to 2\gamma$ decay and using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[53] Using the 1996 and 1998 data.
[54] (2.3 ± 0.3)% correction for other decay modes of the $\omega(782)$ applied.
[55] Using the 1996 data.
[56] Using the 1998 data.
[57] Theoretical analysis of BRAMON 00 taking into account phase-space difference, electromagnetic radiative corrections, as well as isospin breaking, predicts 0.62. FISCHBACH 02 calculates additional corrections caused by the close threshold and predicts 0.68.
[58] Using $B(\eta \to \gamma\gamma) = (39.25 \pm 0.32)\%$, $B(\phi \to \eta\gamma) = (1.26 \pm 0.06)\%$, and $B(\phi \to e^+e^-) = (3.00 \pm 0.06) \times 10^{-4}$.
[59] The average of the branching ratios separately obtained from the $\eta \to \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$ decays.
[60] From $\eta \to \gamma\gamma$ decays and using $B(\eta \to \gamma\gamma) = (39.33 \pm 0.25) \times 10^{-2}$, $B(\eta \to \pi^+\pi^-\gamma) = (4.75 \pm 11) \times 10^{-2}$, and $B(\phi \to \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
[61] From $\eta \to 3\pi^0$ decays and using $B(\pi^0 \to \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\eta \to 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$, $B(\eta \to \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$, and $B(\phi \to \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
[62] From $\eta \to \pi^+\pi^-\pi^0$ decays and using $B(\pi^0 \to \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\pi^0 \to e^+e^-\gamma) = (1.198 \pm 0.032) \times 10^{-2}$, $B(\eta \to \pi^+\pi^-\pi^0) = (23.0 \pm 0.4) \times 10^{-2}$, $B(\phi \to \pi^+\pi^-\pi^0) = (15.5 \pm 0.6) \times 10^{-2}$, and $B(\phi \to \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
[63] AMBROSINO 07A reports $[B(\phi(1020) \to \eta'(958)\gamma) / B(\phi(1020) \to \eta\gamma)] = (4.77 \pm 0.09 \pm 0.19) \times 10^{-3}$. We multiply by our best value $B(\phi(1020) \to \eta\gamma) = (1.305 \pm 0.025) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
[64] Averaging AULCHENKO 03B with AULCHENKO 99.
[65] Using $B(\phi \to \eta\gamma) = (1.297 \pm 0.033)\%$.
[66] Using the value $B(\phi \to \eta\gamma) = (1.26 \pm 0.06) \times 10^{-2}$.
[67] Using $B(\phi \to K^0_L K^0_S) = (33.8 \pm 0.6)\%$.
[68] Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.
[69] Using the value $B(\eta' \to \eta\pi^+\pi^-) = (43.7 \pm 1.5) \times 10^{-2}$ and $B(\eta \to \gamma\gamma) = (39.25 \pm 0.31) \times 10^{-2}$.
[70] Using the value $B(\phi \to \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.
[71] Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.
[72] Supersedes ALOISIO 02D.
[73] From the combined fit of the photon spectra in the reactions $e^+e^- \to \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.
[74] From the negative interference with the $f_0(600)$ meson of AITALA 01B using the ACHASOV 89 parameterization for the $f_0(980)$, a Breit-Wigner for the $f_0(600)$, and ACHASOV 01F for the $\rho\pi$ contribution.
[75] 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 $B(f_0 \to \pi^+\pi^-) = 2B(f_0 \to \pi^0\pi^0)$.
[76] For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.
[77] Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).
[78] A narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
[79] For destructive interference with the Bremsstrahlung process
[80] For constructive interference with the Bremsstrahlung process
[81] Using various branching ratios from the 2000 Edition of this Review (PDG 00).

[82] 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}.
[83] From the decay mode $\eta \to \gamma\gamma$.
[84] From the decay mode $\eta \to \pi^+\pi^-\pi^0$.
[85] Supersedes ACHASOV 98B.
[86] Using $M_{a_0(980)}$=984.8 MeV and assuming $a_0(980)\gamma$ dominance.
[87] Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.
[88] Using data of ACHASOV 00F.
[89] Using results of ALOISIO 02D and assuming that $f_0(980)$ decays into $\pi\pi$ only and $a_0(980)$ into $\eta\pi$ only.
[90] 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.
[91] From the decay mode $\eta' \to \eta\pi^+\pi^-$, $\eta \to \gamma\gamma$.
[92] Superseded by AKHMETSHIN 00B.
[93] For $E_\gamma > 20$ MeV.
[94] From a fit without limitations on charged and neutral ρ masses and widths.
[95] Adding the direct and $\omega\pi$ contributions and considering the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.
[96] Neglecting the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

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

VALUE (units 10^{-2})	*CL%*	*EVTS*		*DOCUMENT ID*		*TECN*	*COMMENT*
9.1±1.2 OUR AVERAGE							
10.1±4.4±1.7		80k	[97]	AKHMETSHIN	06	CMD2	1.017–1.021 $e^+e^- \to \pi^+\pi^-\pi^0$
9.0±1.1±0.6		1.98M	[98,99]	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	[99]	ACHASOV	02	SND	$e^+e^- \to \pi^+\pi^-\pi^0$
$-16 < a_1 < 11$	90	9.8k	[97,100]	AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\gamma\gamma$

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

ϕ(1020) REFERENCES

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AMBROSINO	07A	PL B648 267	F. Ambrosino *et al.*	(KLOE Collab.)
ACHASOV	06A	PR D74 014016	M.N. Achasov *et al.*	(SND Collab.)
AKHMETSHIN	06	PL B642 203	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
AMBROSINO	05	PL B608 199	F. Ambrosino *et al.*	(KLOE Collab.)
AUBERT,B	05J	PR D72 052008	B. Aubert *et al.*	(BABAR Collab.)
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
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ALOISIO	03	PL B561 55	A. Aloisio *et al.*	(KLOE Collab.)
AULCHENKO	03B	JETP 97 24	V.M. Aulchenko *et al.*	(Novosibirsk SND Collab.)
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ACHASOV	00	EPJ C12 25	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
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		Translated from ZETF 117 22.		
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AKHMETSHIN	00B	PL B473 337	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	00E	PL B491 81	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
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AULCHENKO	00A	JETP 90 927	V.M. Aulchenko *et al.*	(Novosibirsk SND Collab.)
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AKHMETSHIN	95	PL B364 199	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
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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)
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STOTTLE...	71	Thesis ORO 2504 170	A.R. Stottlemyer	(UMD)
BIZOT	70	PL 32 416	J.C. Bizot *et al.*	(ORSAY)
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EARLES	70	PRL 25 1312	D.R. Earles *et al.*	(NEAS)
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)
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SCHLEIN	63	PRL 10 368	P.E. Schlein *et al.*	(UCLA) IGJP

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