$\phi(1020)$

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

$\phi(1020)$ MASS

We average mass and width values only when the systematic errors have been evaluated.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1019.456±0.020 OUR AVERAGE Error includes scale factor of 1.1.					
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 $pA \to 4KX$
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	[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. • • •					
1019.8 ±0.7		ARMSTRONG	86	OMEG	85 $\pi^+/pp \to \pi^+/p4Kp$
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 $\overline{p}p \rightarrow K^0_S K^0_L \pi^+ \pi^-$
1020	±1	383	[6] BALDI	77	CNTR	10 $\pi^- p \rightarrow \pi^- \phi p$
1018.9	±0.6	800	COHEN	77	ASPK	6 $\pi^\pm N \rightarrow K^+ K^- N$
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, DEGROOT 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.

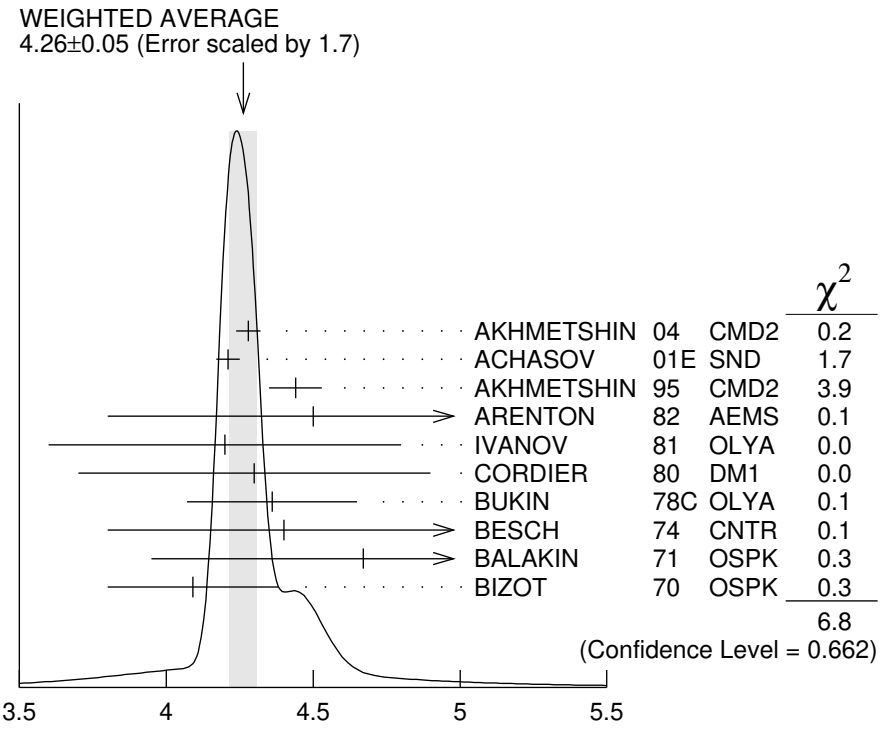
$\phi(1020)$ WIDTH

We average mass and width values only when the systematic errors have been evaluated.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.26 ±0.05 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.			
4.280±0.033±0.025	272k	[9] AKHMETSHIN	04	CMD2	$e^+ e^- \rightarrow K^0_L K^0_S$
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. • • •

4.45	±0.06	271k		DIJKSTRA	86	SPEC	100 π^- Be
3.6	±0.8	337	[11]	COOPER	78B	HBC	0.7–0.8 $\overline{p}p \rightarrow K^0_S K^0_L \pi^+ \pi^-$
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 $K^- p \rightarrow K\overline{K} n$



[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.

$\phi(1020)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$K^+ K^-$	(49.1 ±0.6) %	S=1.2
Γ_2	$K^0_L K^0_S$	(34.0 ±0.5) %	S=1.1
Γ_3	$\rho\pi + \pi^+ \pi^- \pi^0$	(15.4 ±0.5) %	S=1.3
Γ_4	$\rho\pi$		

Γ_5	$\pi^+\pi^-\pi^0$			
Γ_6	$\eta\gamma$	$(\ 1.295\pm0.025)$	%	S=1.1
Γ_7	$\pi^0\gamma$	$(\ 1.23\ \pm0.10\ )\times10^{-3}$		
Γ_8	e^+e^-	$(\ 2.98\ \pm0.04\ )\times10^{-4}$		S=1.1
Γ_9	$\mu^+\mu^-$	$(\ 2.85\ \pm0.19\ )\times10^{-4}$		
Γ_{10}	ηe^+e^-	$(\ 1.15\ \pm0.10\ )\times10^{-4}$		
Γ_{11}	$\pi^+\pi^-$	$(\ 7.3\ \ \pm1.3\ \ )\times10^{-5}$		
Γ_{12}	$\omega\pi^0$	$(\ 5.2\ \ ^{+1.3}_{-1.1}\ )\times10^{-5}$		
Γ_{13}	$\omega\gamma$	$<\ 5$	%	CL=84%
Γ_{14}	$\rho\gamma$	$<\ 1.2$	$\times10^{-5}$	CL=90%
Γ_{15}	$\pi^+\pi^-\gamma$	$(\ 4.1\ \ \pm1.3\ \ )\times10^{-5}$		
Γ_{16}	$f_0(980)\gamma$	$(\ 4.40\ \pm0.21\ )\times10^{-4}$		
Γ_{17}	$\pi^0\pi^0\gamma$	$(\ 1.09\ \pm0.06\ )\times10^{-4}$		
Γ_{18}	$\pi^+\pi^-\pi^+\pi^-$	$(\ 3.9\ \ ^{+2.8}_{-2.2}\ )\times10^{-6}$		
Γ_{19}	$\pi^+\pi^+\pi^-\pi^-\pi^0$	$<\ 4.6$	$\times10^{-6}$	CL=90%
Γ_{20}	$\pi^0e^+e^-$	$(\ 1.12\ \pm0.28\ )\times10^{-5}$		
Γ_{21}	$\pi^0\eta\gamma$	$(\ 8.3\ \ \pm0.5\ \ )\times10^{-5}$		
Γ_{22}	$a_0(980)\gamma$	$(\ 7.6\ \ \pm0.6\ \ )\times10^{-5}$		
Γ_{23}	$\eta'(958)\gamma$	$(\ 6.2\ \ \pm0.7\ \ )\times10^{-5}$		S=1.1
Γ_{24}	$\eta\pi^0\pi^0\gamma$	$<\ 2$	$\times10^{-5}$	CL=90%
Γ_{25}	$\mu^+\mu^-\gamma$	$(\ 1.4\ \ \pm0.5\ \ )\times10^{-5}$		
Γ_{26}	$\rho\gamma\gamma$	$<\ 5$	$\times10^{-4}$	CL=90%
Γ_{27}	$\eta\pi^+\pi^-$	$<\ 1.8$	$\times10^{-5}$	CL=90%
Γ_{28}	$\eta\mu^+\mu^-$	$<\ 9.4$	$\times10^{-6}$	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to 25 branching ratios uses 67 measurements and one constraint to determine 12 parameters. The overall fit has a $\chi^2 = 55.8$ for 56 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	−68									
x_3	−64	−13								
x_6	−25	24	3							
x_7	−10	9	1	8						
x_8	49	−53	−8	−47	−17					
x_9	−7	8	1	7	3	−15				
x_{11}	−4	4	1	3	1	−7	1			
x_{16}	0	0	0	0	0	0	0	0		
x_{18}	−1	1	0	1	0	−2	0	0	0	
x_{22}	0	0	0	0	0	0	0	0	0	0
x_{23}	−5	4	1	18	1	−8	1	1	0	0
	x_1	x_2	x_3	x_6	x_7	x_8	x_9	x_{11}	x_{16}	x_{18}

x_{23}	0
	x_{22}

$\phi(1020)$ 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	$e^+ e^- \to \pi^0\gamma$

$\Gamma(e^+ e^-)$ Γ_8

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.27 ± 0.04 OUR EVALUATION					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.27 ± 0.03	272k	[13] AKHMETSHIN	04	CMD2	$e^+ e^- \to K_L^0 K_S^0$

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

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

$\Gamma(e^+e^-) \times \Gamma(K^+K^-)/\Gamma^2_{total}$ $\Gamma_8\Gamma_1/\Gamma^2$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
14.60±0.33 OUR FIT	Error includes scale factor of 1.2.				
13.93±0.14±0.99	1000k	[14] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$

$\Gamma(e^+e^-) \times \Gamma(K^0_LK^0_S)/\Gamma^2_{total}$ $\Gamma_8\Gamma_2/\Gamma^2$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
10.11±0.14 OUR FIT					
10.06±0.16 OUR AVERAGE					
10.01±0.04±0.17	272k	[15] AKHMETSHIN	04	CMD2	$e^+e^- \to K^0_LK^0_S$
10.27±0.07±0.34	500k	[14] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$

$\Gamma(e^+e^-) \times [\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)]/\Gamma^2_{total}$ $\Gamma_8\Gamma_3/\Gamma^2$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
4.60 ±0.14 OUR FIT	Error includes scale factor of 1.2.				
4.52 ±0.19 OUR AVERAGE					
4.665±0.042±0.261	400k	[14] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$
4.35 ±0.27 ±0.08	11169	[16] AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma^2_{total}$ $\Gamma_8\Gamma_6/\Gamma^2$

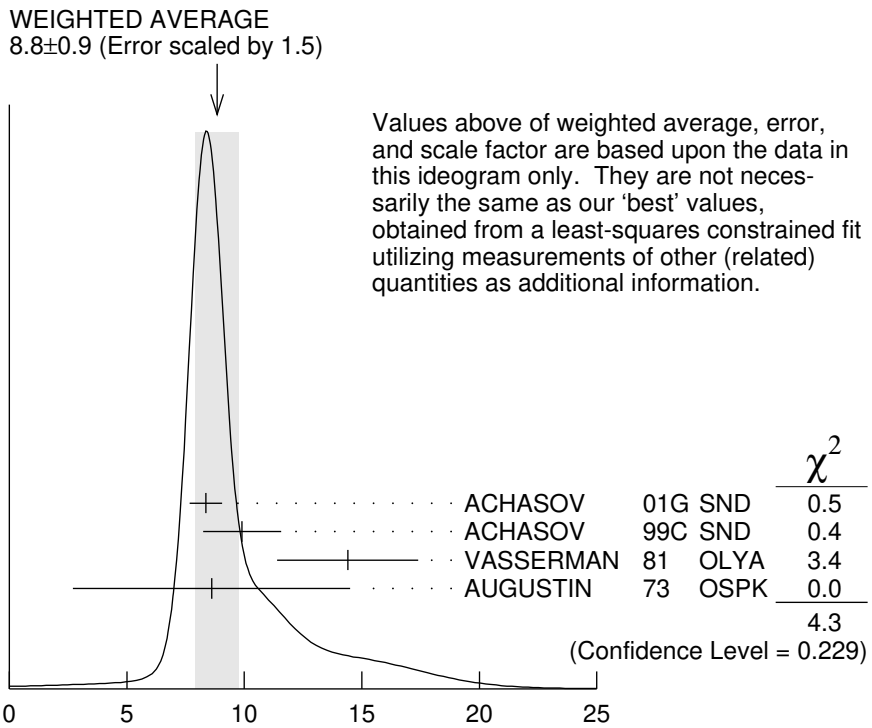
VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
3.85 ±0.07 OUR FIT	Error includes scale factor of 1.2.				
3.89 ±0.08 OUR AVERAGE	Error includes scale factor of 1.2.				
3.850±0.041±0.159	23k	[17,18] AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
4.00 ±0.04 ±0.11		[19] ACHASOV	00	SND	$e^+e^- \to \eta\gamma$
3.765±0.092±0.143		[20] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$
4.017±0.035±0.124	23k	[21] ACHASOV	00D	SND	$e^+e^- \to \eta\gamma$
3.53 ±0.08 ±0.17	2200	[20,22] AKHMETSHIN	99F	CMD2	$e^+e^- \to \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.848±0.036±0.070		[23] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$

$\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma^2_{total}$ $\Gamma_8\Gamma_7/\Gamma^2$

VALUE (units 10^{-7})	DOCUMENT ID		TECN	COMMENT
3.67±0.28 OUR FIT				
$3.67\pm0.10^{+0.27}_{-0.25}$	[24] ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$

$\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-)/\Gamma^2_{\rm total}$ $\Gamma_8\Gamma_9/\Gamma^2$

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	[22] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
14.4 ±3.0	[16] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
8.6 ±5.9	[16] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$



$\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-)/\Gamma^2_{\rm total}$ $\Gamma_8\Gamma_9/\Gamma^2$

$\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-)/\Gamma^2_{\rm total}$ $\Gamma_8\Gamma_{11}/\Gamma^2$

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	[22] ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$1.95^{+1.15}_{-0.87}$	[16] GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$6.01^{+3.19}_{-2.51}$	[16] VASSERMAN	81	OLYA	$e^+e^- \to \pi^+\pi^-$

$\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma^2_{\rm total}$ $\Gamma_8\Gamma_{18}/\Gamma^2$

VALUE (units 10^{-9})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$1.2\ ^{+0.8}_{-0.7}$ OUR FIT					
1.17±0.52±0.64	3285	[22] AKHMETSHIN	00E	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-$

[14] 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.
[15] Update of AKHMETSHIN 01D
[16] Recalculated by us from the cross section in the peak.
[17] From the $\eta \to 3\pi^0$ decay and using $B(\eta \to 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
[18] 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).
[19] From the $\eta \to 2\gamma$ decay and using $B(\eta \to 2\gamma) = (39.21 \pm 0.34) \times 10^{-2}$.
[20] From the $\eta \to \pi^+\pi^-\pi^0$ decay and using $B(\eta \to \pi^+\pi^-\pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.
[21] From the $\eta \to 3\pi^0$ decay and using $B(\eta \to 3\pi^0) = (32.2 \pm 0.4) \times 10^{-2}$.
[22] Recalculated by the authors from the cross section in the peak.
[23] Using various decay modes of the η from ACHASOV 98F, ACHASOV 00, and ACHASOV 00B.
[24] 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
0.491±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	[25] 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	[25] 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 $K^-p \to \Lambda K^0_LK^0_S$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.154±0.005 OUR FIT	Error includes scale factor of 1.3.				
0.151±0.009 OUR AVERAGE	Error includes scale factor of 1.7.				
0.161±0.008	11761	AKHMETSHIN	95	CMD2	$e^+e^-\to\pi^+\pi^-\pi^0$
0.143±0.007		DOLINSKY	91	ND	$e^+e^-\to\pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.159±0.008	400k	[25] ACHASOV	01E	SND	$e^+e^-\to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$
0.145±0.009±0.003	11169	[26] AKHMETSHIN	98	CMD2	$e^+e^-\to\pi^+\pi^-\pi^0$
0.139±0.007		[27] 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
0.409±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
0.186±0.006 OUR FIT	Error includes scale factor of 1.2.			
0.24 ±0.04 OUR AVERAGE				
0.237±0.039	CERRADA	77B	HBC	4.2 $K^-p\to\Lambda3\pi$
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
0.455±0.015 OUR FIT	Error includes scale factor of 1.2.				
0.51 ±0.05 OUR AVERAGE					
0.56 ±0.07	3681	BUKIN	78C	OLYA	$e^+e^-\to K^0_LK^0_S$, $\pi^+\pi^-\pi^0$
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	$e^+e^-\to\eta\gamma$, $\pi^0\gamma$

$\Gamma(\mu^+\mu^-)/\Gamma_{total}$ — Γ_9/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	[28] HAYES	71	CNTR	8.3,9.8 $\gamma C\to\mu^+\mu^-X$
2.17±0.60	[28] 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	[29] ACHASOV	01G	SND	$e^+e^- \to \mu^+\mu^-$
3.30±0.45±0.32	[26] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
4.83±1.02	[30] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
2.87±1.98	[30] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.01295±0.00025 OUR FIT Error includes scale factor of 1.1.					
0.0126 ±0.0004 OUR AVERAGE					
0.01246±0.00025±0.00057	10k	[31] ACHASOV	98F	SND	$e^+e^- \to 7\gamma$
0.0118 ±0.0011	279	[32] AKHMETSHIN	95	CMD2	$e^+e^- \to \pi^+\pi^- 3\gamma$
0.0130 ±0.0006		[33] DRUZHININ	84	ND	$e^+e^- \to 3\gamma$
0.014 ±0.002		[34] DRUZHININ	84	ND	$e^+e^- \to 6\gamma$
0.0088 ±0.0020	290	KURDADZE	83C	OLYA	$e^+e^- \to 3\gamma$
0.0135 ±0.0029		ANDREWS	77	CNTR	6.7–10 γ Cu
0.015 ±0.004	54	[33] COSME	76	OSPK	e^+e^-

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

0.01287±0.00013±0.00063	[35,36] AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
0.01338±0.00012±0.00052	[37] ACHASOV	00	SND	$e^+e^- \to \eta\gamma$
0.01287±0.00012±0.00042	[38] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$
0.01259±0.00030±0.00059	[39] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$
0.01343±0.00012±0.00055	23k [31] ACHASOV	00D	SND	$e^+e^- \to \eta\gamma$
0.0118 ±0.0003 ±0.0006	2200 [40] AKHMETSHIN	99F	CMD2	$e^+e^- \to \eta\gamma$
0.0121 ±0.0007	[41] BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \to \eta\gamma$

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.41±0.12±0.04		30175	[42] AKHMETSHIN	99B	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$

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

< 0.3	90	[43] 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

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

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

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

VALUE (units 10^{-4})	CL%		DOCUMENT ID		TECN	COMMENT
< 0.12	90	[44]	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

$\Gamma(e^+e^-)/\Gamma_{total}$ Γ_8/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	[45]	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		[46]	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^-

$\Gamma(\pi^0\gamma)/\Gamma_{total}$ 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. • • •						
$1.226\pm0.036^{+0.096}_{-0.089}$		[47]	ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$
1.26 ±0.17		[41]	BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \to$ $\pi^0\gamma$

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

VALUE (units 10^{-4})	CL%		DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$0.71\pm0.11\pm0.09$		[26]	ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$0.65^{+0.38}_{-0.29}$		[26]	GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$2.01^{+1.07}_{-0.84}$		[26]	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_{12}/Γ

VALUE (units 10^{-5})		DOCUMENT ID		TECN	COMMENT
$\mathbf{5.2^{+1.3}_{-1.1}}$	[48,49]	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	[50] ACHASOV	00E	SND	$e^+e^- \to \pi^0\pi^0\gamma$
$5.5^{+1.6}_{-1.4}\pm0.3$	[49,51] AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
$4.8^{+1.9}_{-1.7}\pm0.8$	[50] 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
0.692±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 $K^-p \to \phi$ hyperon
0.71 ±0.05		LAVEN	77	HBC	10 $K^-p \to K^+K^-\Lambda$
0.71 ±0.08		LYONS	77	HBC	3–4 $K^-p \to \Lambda\phi$
0.89 ±0.10	144	AGUILAR-...	72B	HBC	3.9,4.6 K^-p

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

0.68 ±0.03	[52] 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
0.315±0.012 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_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.15±0.10 OUR AVERAGE					
1.19±0.19±0.12	213	[53] ACHASOV	01B	SND	$e^+e^- \to \gamma\gamma e^+e^-$
1.14±0.10±0.06	355	[54] 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	[55] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
1.21±0.14±0.09	130	[56] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
1.04±0.20±0.08	42	[57] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$

$\Gamma(\eta'(958)\gamma)/\Gamma_{total}$ Γ_{23}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
6.2 ±0.7 OUR FIT	Error includes scale factor of 1.1.					
6.7 $^{+2.8}_{-2.4}$ ±0.8		12	[58] 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	$e^+e^- \to 7\gamma$

$6.10 \pm 0.61 \pm 0.43$		120	[59] ALOISIO	02E	KLOE	$1.02\ e^+ e^- \to \pi^+ \pi^- 3\gamma$	
$8.2\ ^{+2.1}_{-1.9} \pm 1.1$		21	[60] AKHMETSHIN	00B	CMD2	$e^+ e^- \to \pi^+ \pi^- 3\gamma$	
$4.9\ ^{+2.2}_{-1.8} \pm 0.6$		9	[61] AKHMETSHIN	00F	CMD2	$e^+ e^- \to \pi^+ \pi^- \pi^+ \pi^- \geq 2\gamma$	
6.4 ± 1.6		30	[62] AKHMETSHIN	00F	CMD2	$e^+ e^- \to \eta'(958)\gamma$	
$6.7\ ^{+3.4}_{-2.9} \pm 1.0$		5	[63] AULCHENKO	99	SND	$e^+ e^- \to \pi^+ \pi^- 3\gamma$	
<11	90		AULCHENKO	98	SND	$e^+ e^- \to 7\gamma$	
$12\ ^{+7}_{-5} \pm 2$		6	[60] AKHMETSHIN	97B	CMD2	$e^+ e^- \to \pi^+ \pi^- 3\gamma$	
<41	90		DRUZHININ	87	ND	$e^+ e^- \to \gamma\eta\pi^+\pi^-$	

$\Gamma(\eta\pi^0\pi^0\gamma)/\Gamma_{total}$ Γ_{24}/Γ

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

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

VALUE (units 10^{-4})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.09 ± 0.06 OUR AVERAGE						
$1.09 \pm 0.03 \pm 0.05$		2438	ALOISIO	02D	KLOE	$e^+ e^- \to \pi^0 \pi^0 \gamma$
$1.08 \pm 0.17 \pm 0.09$		268	AKHMETSHIN	99C	CMD2	$e^+ e^- \to \pi^0 \pi^0 \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$1.158 \pm 0.093 \pm 0.052$		419 [64,65]	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_{17}/Γ_6

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$0.865 \pm 0.070 \pm 0.017$	419 [65]	ACHASOV	00H	SND	$e^+ e^- \to \pi^0 \pi^0 \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.90 \pm 0.08 \pm 0.07$	164	ACHASOV	98I	SND	$e^+ e^- \to 5\gamma$

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

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

$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{total}$ Γ_{18}/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_{16}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
4.40 ± 0.21 OUR FIT						
4.44 ± 0.21 OUR AVERAGE						
4.47 ± 0.21		2438	[66] ALOISIO	02D	KLOE	$e^+e^-\to\pi^0\pi^0\gamma$
$2.90\pm0.21\pm1.54$			[67] 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. • • •						
$3.5\ \pm0.3\ ^{+1.3}_{-0.5}$		419	[64,68] ACHASOV	00H	SND	$e^+e^-\to\pi^0\pi^0\gamma$
$1.93\pm0.46\pm0.50$		27188	[69] AKHMETSHIN	99B	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
$3.05\pm0.25\pm0.72$		268	[70] AKHMETSHIN	99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
$1.5\ \pm0.5$		268	[71] AKHMETSHIN	99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
$3.42\pm0.30\pm0.36$		164	[68] ACHASOV	98I	SND	$e^+e^-\to5\gamma$
< 1	90		[72] AKHMETSHIN	97C	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
< 7	90		[73] 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_{16}/Γ_6

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
3.40 ± 0.18 OUR FIT	Error includes scale factor of 1.1.				
$2.6\ \pm0.2\ ^{+0.8}_{-0.3}$	419	[68] ACHASOV	00H	SND	$e^+e^-\to\pi^0\pi^0\gamma$

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.12 ± 0.28 OUR AVERAGE						
$1.01\pm0.28\pm0.29$		52	[74] ACHASOV	02D	SND	$e^+e^-\to\pi^0e^+e^-$
$1.22\pm0.34\pm0.21$		46	[75] 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_{21}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
8.3 ±0.5 OUR AVERAGE						
8.51±0.51±0.57		607	[76] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
7.96±0.60±0.40		197	[77] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
8.8 ±1.4 ±0.9		36	[78] 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. • • •						
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_{22}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
7.6±0.6 OUR FIT						
7.6±0.6 OUR AVERAGE						
7.4±0.7			[79] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
8.8±1.7		36	[80] ACHASOV	00F	SND	$e^+e^- \to \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
11 ±2			[81] 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_{16}/Γ_{22}

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
6.1±0.6	[82] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$

$\Gamma(\eta'(958)\gamma)/\Gamma(K_L^0K_S^0)$ Γ_{23}/Γ_2

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.83±0.21 OUR FIT Error includes scale factor of 1.1.					
$\mathbf{1.46^{+0.64}_{-0.54}\pm0.18}$	9	[83] AKHMETSHIN	00F	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$

$\Gamma(\eta'(958)\gamma)/\Gamma(\eta\gamma)$ Γ_{23}/Γ_6

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
4.8 ±0.5 OUR FIT Error includes scale factor of 1.1.					
4.9 ±0.5 OUR AVERAGE					
4.70±0.47±0.31	120	[84] 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	[85] AKHMETSHIN	97B	CMD2	$e^+e^- \to \pi^+\pi^-3\gamma$

$\Gamma(\mu^+\mu^-\gamma)/\Gamma_{total}$ Γ_{25}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
1.43±0.45±0.14	27188	[69] 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	[86] AKHMETSHIN	97C	CMD2	$e^+e^- \to \mu^+\mu^-\gamma$

$\Gamma(\rho\gamma\gamma)/\Gamma_{total}$ Γ_{26}/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_{27}/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_{28}/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 [87,88]	ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
<0.0006	90	[89]	ACHASOV	02	SND	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
<0.23	90	[89]	CORDIER	80	DM1	$e^+e^- \to \pi^+\pi^-\pi^0$
<0.20	90	[89]	PARROUR	76B	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$

[25] Using $B(\phi \to e^+e^-) = (2.93 \pm 0.14) \times 10^{-4}$.
[26] Using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[27] 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.
[28] Neglecting interference between resonance and continuum.
[29] Using $B(\phi \to e^+e^-) = (2.91 \pm 0.07) \times 10^{-4}$.
[30] Recalculated by us using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[31] Using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \to 3\pi^0) = (32.2 \pm 0.4) \times 10^{-2}$.
[32] From $\pi^+\pi^-\pi^0$ decay mode of η.
[33] From 2γ decay mode of η.
[34] From $3\pi^0$ decay mode of η.
[35] Using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \to 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
[36] 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).
[37] From the $\eta \to 2\gamma$ decay and using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[38] Using various decay modes of the η from ACHASOV 98F, ACHASOV 00, and ACHASOV 00B and $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[39] From the $\eta \to \pi^+\pi^-\pi^0$ decay and $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[40] From $\pi^+\pi^-\pi^0$ decay mode of η and using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
[41] Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.
[42] For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \to f_0(980)\gamma)$ is negligible. Supersedes AKHMETSHIN 97C.
[43] For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \to f_0(980)\gamma)$ is negligible.
[44] Supersedes AKHMETSHIN 97C.

[45] 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.

[46] 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.

[47] From the $\pi^0 \to 2\gamma$ decay and using $B(\phi \to e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

[48] Using the 1996 and 1998 data.

[49] (2.3 ± 0.3)% correction for other decay modes of the $\omega(782)$ applied.

[50] Using the 1996 data.

[51] Using the 1998 data.

[52] 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.

[53] Using $B(\eta \to \gamma\gamma) = (39.25 \pm 0.32)\%$, $B(\phi \to \eta\gamma) = (1.26 \pm 0.06)\%$, and $B(\phi \to e^+e^-) = (3.00 \pm 0.06) \times 10^{-4}$.

[54] The average of the branching ratios separately obtained from the $\eta \to \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$ decays.

[55] 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 $B(\phi \to \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.

[56] 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 $B(\phi \to \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.

[57] 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 $B(\phi \to \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.

[58] Averaging AULCHENKO 03B with AULCHENKO 99.

[59] Using $B(\phi \to \eta\gamma) = (1.297 \pm 0.033)\%$.

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

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

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

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

[64] Using the value $B(\phi \to \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.

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

[66] 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.

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

[68] 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 $B(f_0 \to \pi^+\pi^-) = 2B(f_0 \to \pi^0\pi^0)$.

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

[70] Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).

[71] A narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.

[72] For destructive interference with the Bremsstrahlung process

[73] For constructive interference with the Bremsstrahlung process

[74] Using various branching ratios from the 2000 Edition of this Review (PDG 00).

[75] Using $B(\pi^0 \to \gamma\gamma) = 0.98798 \pm 0.00032$, $B(\phi \to \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$, and $B(\eta \to \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$.

[76] From the decay mode $\eta \to \gamma\gamma$.

[77] From the decay mode $\eta \to \pi^+\pi^-\pi^0$.
[78] Supersedes ACHASOV 98B.
[79] Using $M_{a_0(980)}$=984.8 MeV and assuming $a_0(980)\gamma$ dominance.
[80] Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.
[81] Using data of ACHASOV 00F.
[82] Using results of ALOISIO 02D and assuming that $f_0(980)$ decays into $\pi\pi$ only and $a_0(980)$ into $\eta\pi$ only.
[83] 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.
[84] From the decay mode $\eta' \to \eta\pi^+\pi^-$, $\eta \to \gamma\gamma$.
[85] Superseded by AKHMETSHIN 00B.
[86] For $E_\gamma > 20$ MeV.
[87] From a fit without limitations on charged and neutral ρ masses and widths.
[88] Adding the direct and $\omega\pi$ contributions and considering the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.
[89] 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	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.090±0.011±0.006		1.98M	[91,92] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$-0.06 < a_1 < 0.06$		500k	[93] ACHASOV	02	SND	$e^+e^- \to \pi^+\pi^-\pi^0$
$-0.16 < a_1 < 0.11$	90		[90] AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\gamma\gamma$

[90] Dalitz plot analysis of 9735 events taking into account interference between the contact and $\rho\pi$ terms and assuming zero phase for the contact term.
[91] From a fit without limitations on charged and neutral ρ masses and widths.
[92] Recalculated by us to match the notations of AKHMETSHIN 98.
[93] Recalculated by the authors to match the notations of AKHMETSHIN 98.

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