$\phi(1020)$

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

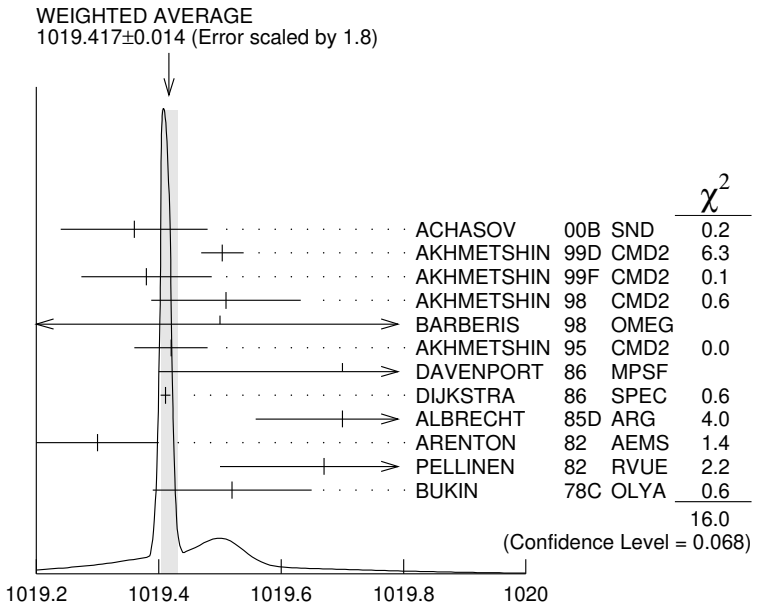
$\phi(1020)$ MASS

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

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1019.417±0.014 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.					
1019.36 ±0.12		[1] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$
1019.504±0.011±0.033	314k	AKHMETSHIN	99D	CMD2	$e^+e^- \to K_L^0 K_S^0$
1019.38 ±0.07 ±0.08	2200	[2] 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 $pA \to 4KX$
1019.411±0.008	642k	[3] DIJKSTRA	86	SPEC	100–200 $\pi^\pm$, $\overline{p}$, p, $K^\pm$, on Be
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	[4] 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	[5] ATKINSON	86	OMEG	20–70 γp
1019.7 ±1.0		BEBEK	86	CLEO	$e^+e^- \to \Upsilon(4S)$
1020.9 ±0.2		[5] FRAME	86	OMEG	13 $K^+p \to \phi K^+p$
1021.0 ±0.2		[5] ARMSTRONG	83B	OMEG	18.5 $K^-p \to K^-K^+\Lambda$
1020.0 ±0.5		[5] ARMSTRONG	83B	OMEG	18.5 $K^-p \to K^-K^+\Lambda$
1019.7 ±0.3		[5] 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	[5] BALDI	77	CNTR	10 $\pi^- p \to \pi^-\phi p$

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	[6]	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \rightarrow \Lambda K^+ K^-$
1019.9	±0.5	100	[6]	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] Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included.
[2] Using a total width of 4.43 ± 0.05 MeV.
[3] Weighted and scaled average of 12 measurements of DIJKSTRA 86.
[4] PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DEGROOT 74.
[5] Systematic errors not evaluated.
[6] Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.



$\phi(1020)$ mass (MeV)

$\phi(1020)$ WIDTH

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

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.458±0.032 OUR AVERAGE					
4.477±0.036±0.022	314k	AKHMETSHIN	99D	CMD2	$e^+e^- \to K^0_L K^0_S$
4.44 ±0.09	55600	AKHMETSHIN	95	CMD2	$e^+e^- \to$ hadrons
4.45 ±0.06	271k	DIJKSTRA	86	SPEC	100 π^- Be
4.5 ±0.7	1500	ARENTON	82	AEMS	11.8 polar. $pp \to KK$
4.2 ±0.6	766 [7]	IVANOV	81	OLYA	1–1.4 $e^+e^- \to K^+K^-$
4.3 ±0.6	[7]	CORDIER	80	WIRE	$e^+e^- \to \pi^+\pi^-\pi^0$
4.36 ±0.29	3681 [7]	BUKIN	78C	OLYA	$e^+e^- \to$ hadrons
4.4 ±0.6	984 [7]	BESCH	74	CNTR	$2\gamma p \to p K^+ K^-$
4.67 ±0.72	681 [7]	BALAKIN	71	OSPK	$e^+e^- \to$ hadrons
4.09 ±0.29		BIZOT	70	OSPK	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.6 ±0.8	337 [7]	COOPER	78B	HBC	0.7–0.8 $\overline{p}p \to K^0_S K^0_L \pi^+\pi^-$
4.5 ±0.50	1300 [7,8]	AKERLOF	77	SPEC	400 pA $\to K^+K^-$X
4.5 ±0.8	500 [7,8]	AYRES	74	ASPK	3–6 $\pi^- p \to K^+K^- n$, $K^- p \to K^+K^-\Lambda/\Sigma^0$
3.81 ±0.37		COSME	74B	OSPK	$e^+e^- \to K^0_L K^0_S$
3.8 ±0.7	454 [7]	BORENSTEIN	72	HBC	2.18 $K^- p \to K\overline{K}n$

[7] Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
[8] Systematic errors not evaluated.

$\phi(1020)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	K^+K^-	(49.4 ±0.7) %	S=1.3
Γ_2	$K^0_L K^0_S$	(33.6 ±0.6) %	S=1.3
Γ_3	$\rho\pi + \pi^+\pi^-\pi^0$	(15.5 ±0.6) %	S=1.4
Γ_4	$\rho\pi$		
Γ_5	$\pi^+\pi^-\pi^0$		
Γ_6	$\eta\gamma$	(1.298±0.029) %	S=1.2
Γ_7	$\pi^0\gamma$	(1.24 ±0.10) $\times 10^{-3}$	
Γ_8	e^+e^-	(2.96 ±0.05) $\times 10^{-4}$	S=1.3
Γ_9	$\mu^+\mu^-$	(2.9 ±0.4) $\times 10^{-4}$	S=1.2
Γ_{10}	ηe^+e^-	(1.3 $^{+0.8}_{-0.6}$) $\times 10^{-4}$	
Γ_{11}	$\pi^+\pi^-$	(7.3 ±1.3) $\times 10^{-5}$	
Γ_{12}	$\omega\pi^0$	(5.2 $^{+1.3}_{-1.1}$) $\times 10^{-5}$	
Γ_{13}	$\omega\gamma$	< 5 %	CL=84%

Γ_{14}	$\rho\gamma$	$<$ 1.2		$\times 10^{-5}$	CL=90%
Γ_{15}	$\pi^+\pi^-\gamma$	(4.1	± 1.3)	$\times 10^{-5}$	
Γ_{16}	$f_0(980)\gamma$	(3.3	$^{+0.8}_{-0.5}$)	$\times 10^{-4}$	
Γ_{17}	$\pi^0\pi^0\gamma$	(1.08	± 0.19)	$\times 10^{-4}$	
Γ_{18}	$\pi^+\pi^-\pi^+\pi^-$				
Γ_{19}	$\pi^+\pi^+\pi^-\pi^-\pi^0$	$<$ 4.6		$\times 10^{-6}$	CL=90%
Γ_{20}	$\pi^0 e^+ e^-$	$<$ 1.2		$\times 10^{-4}$	CL=90%
Γ_{21}	$\pi^0\eta\gamma$	(8.9	± 1.4)	$\times 10^{-5}$	
Γ_{22}	$a_0(980)\gamma$	$<$ 5		$\times 10^{-3}$	CL=90%
Γ_{23}	$\eta'(958)\gamma$	(6.7	$^{+1.5}_{-1.4}$)	$\times 10^{-5}$	
Γ_{24}	$\eta\pi^0\pi^0\gamma$	$<$ 2		$\times 10^{-5}$	CL=90%
Γ_{25}	$\mu^+\mu^-\gamma$	(1.4	± 0.5)	$\times 10^{-5}$	
Γ_{26}	$\rho\gamma\gamma$	$<$ 5		$\times 10^{-4}$	CL=90%
Γ_{27}	$\eta\pi^+\pi^-$	$<$ 1.8		$\times 10^{-5}$	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to 22 branching ratios uses 56 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 54.2$ for 47 degrees of freedom.

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

x_2	−64								
x_3	−56	−28							
x_6	−14	8	3						
x_7	−7	4	2	11					
x_8	25	−19	−9	−46	−23				
x_9	−1	0	0	1	1	−3			
x_{11}	−3	2	1	4	2	−10	0		
x_{16}	−2	1	0	11	1	−5	0	0	
x_{23}	−3	3	−1	4	1	−3	0	0	0
	x_1	x_2	x_3	x_6	x_7	x_8	x_9	x_{11}	x_{16}

$\phi(1020)$ 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. • • •				
$5.40\pm0.16^{+0.43}_{-0.40}$	ACHASOV	00	SND	$e^+e^-\to\pi^0\gamma$

$\Gamma(e^+e^-)$ Γ_8

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.32\pm0.02\pm0.04$	314k	[9] AKHMETSHIN	99D	CMD2	$e^+e^-\to K^0_L K^0_S$

[9] Using B($\phi\to K^0_L K^0_S$)= 0.331 ± 0.009.

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

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

VALUE (units 10^{-5})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
9.95 ±0.23 OUR FIT	Error includes scale factor of 1.6.				
9.756±0.114±0.146	314k	[11] AKHMETSHIN	99D	CMD2	$e^+e^-\to K^0_L K^0_S$

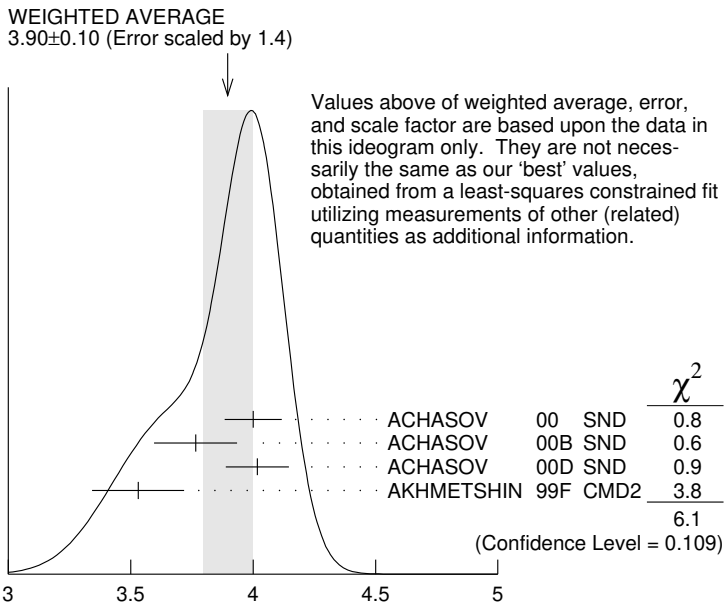
$\Gamma(e^+e^-)\times[\Gamma(\rho\pi)+\Gamma(\pi^+\pi^-\pi^0)]/\Gamma^2_{\text{total}}$ $\Gamma_8\Gamma_3/\Gamma^2$

VALUE (units 10^{-5})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.58±0.18 OUR FIT	Error includes scale factor of 1.3.				
4.35±0.27±0.08	11169	[11] AKHMETSHIN	98	CMD2	$e^+e^-\to\pi^+\pi^-\pi^0$

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

VALUE (units 10^{-6})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3.84 ±0.08 OUR FIT	Error includes scale factor of 1.3.				
3.90 ±0.10 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.				
4.00 ±0.04 ±0.11		[12] ACHASOV	00	SND	$e^+e^-\to\eta\gamma$
$3.765\pm0.092\pm0.143$		[13] ACHASOV	00B	SND	$e^+e^-\to\eta\gamma$
$4.017\pm0.035\pm0.124$	23k	[10] ACHASOV	00D	SND	$e^+e^-\to\eta\gamma$
3.53 ±0.08 ±0.17	2200	[13,14] AKHMETSHIN	99F	CMD2	$e^+e^-\to\eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$3.848\pm0.036\pm0.070$		[15] ACHASOV	00B	SND	$e^+e^-\to\eta\gamma$

[10] From the $\eta\to 3\pi^0$ decay and using B($\eta\to 3\pi^0$) = (32.2 ± 0.4) × 10^{-2}.



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

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

VALUE (units 10^{-7})	*DOCUMENT ID*		*TECN*	*COMMENT*
3.67±0.28 OUR FIT				
$3.67\pm0.10^{+0.27}_{-0.25}$	[16] ACHASOV	00	SND	$e^+ e^- \to \pi^0\gamma$

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

VALUE (units 10^{-8})	*DOCUMENT ID*		*TECN*	*COMMENT*
8.7±1.1 OUR FIT Error includes scale factor of 1.3.				
10.8±1.4 OUR AVERAGE				
9.9±1.4±0.9	[14] ACHASOV	99C	SND	$e^+ e^- \to \mu^+\mu^-$
14.4±3.0	[11] VASSERMAN	81	OLYA	$e^+ e^- \to \mu^+\mu^-$
8.6±5.9	[11] AUGUSTIN	73	OSPK	$e^+ e^- \to \mu^+\mu^-$

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

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	[14] ACHASOV	00C	SND	$e^+ e^- \to \pi^+\pi^-$
$1.95^{+1.15}_{-0.87}$	[11] GOLUBEV	86	ND	$e^+ e^- \to \pi^+\pi^-$
$6.01^{+3.19}_{-2.51}$	[11] VASSERMAN	81	OLYA	$e^+ e^- \to \pi^+\pi^-$

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

VALUE (units 10^{-9})	EVTS	DOCUMENT ID		TECN	COMMENT
1.17±0.52±0.64	3285	[14] AKHMETSHIN	00E	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-$

[11] Recalculated by us from the cross section in the peak.
[12] From the $\eta \to 2\gamma$ decay and using B($\eta \to 2\gamma$) =(39.21 ± 0.34) × 10^{-2}.
[13] From the $\eta \to \pi^+\pi^-\pi^0$ decay and using B($\eta \to \pi^+\pi^-\pi^0$) =(23.1 ± 0.5) × 10^{-2}.
[14] Recalculated by the authors from the cross section in the peak.
[15] Using various decay modes of the η from ACHASOV 98F, ACHASOV 00, and ACHASOV 00B.
[16] From the $\pi^0 \to 2\gamma$ decay and using B($\pi^0 \to 2\gamma$) =(98.798 ± 0.032) × 10^{-2}.

$\phi(1020)$ BRANCHING RATIOS

$\Gamma(K^+K^-)/\Gamma_{total}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.494±0.007 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 $K^-p \to \Lambda K^+K^-$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.336±0.006 OUR FIT Error includes scale factor of 1.3.					
0.331±0.009 OUR AVERAGE					
0.335±0.010	40644	AKHMETSHIN	95	CMD2	$e^+e^- \to K^0_L K^0_S$
0.326±0.035		DOLINSKY	91	ND	$e^+e^- \to K^0_L K^0_S$
0.310±0.024		DRUZHININ	84	ND	$e^+e^- \to K^0_L K^0_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.329±0.006±0.010	314k	[17] AKHMETSHIN	99D	CMD2	$e^+e^- \to K^0_L K^0_S$
0.27 ±0.03	133	KALBFLEISCH	76	HBC	2.18 $K^-p \to \Lambda K^0_L K^0_S$
0.257±0.030	95	BALAKIN	71	OSPK	$e^+e^- \to K^0_L K^0_S$
0.40 ±0.04	167	LINDSEY	66	HBC	2.1–2.7 $K^-p \to \Lambda K^0_L K^0_S$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.155±0.006 OUR FIT Error includes scale factor of 1.4.					
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. • • •					
0.145±0.009±0.003	11169	[18] AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
0.139±0.007		[19] PARROUR	76B	OSPK	e^+e^-

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.405±0.007 OUR FIT Error includes scale factor of 1.3.					
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±0.008 OUR FIT Error includes scale factor of 1.4.				
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 $K^- p \to \Lambda\pi^+\pi^-\pi^0$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.460±0.020 OUR FIT Error includes scale factor of 1.4.					
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	$e^+e^- \to \pi^+\pi^-\pi^0$

$\Gamma(\eta\gamma)/\Gamma(\pi^0\gamma)$ 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	$e^+e^- \to \eta\gamma, \pi^0\gamma$

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

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
2.9 ±0.4 OUR FIT Error includes scale factor of 1.2.				
2.5 ±0.4 OUR AVERAGE				
2.69±0.46	[20] HAYES	71	CNTR	8.3,9.8 γ C $\to \mu^+\mu^-$ X
2.17±0.60	[20] EARLES	70	CNTR	6.0 γ C $\to \mu^+\mu^-$ X
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.30±0.45±0.32	[18] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
4.83±1.02	[21] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
2.87±1.98	[21] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.01298±0.00029 OUR FIT Error includes scale factor of 1.2.					
0.0126 ±0.0004 OUR AVERAGE					
0.01246±0.00025±0.00057	10k	[22] ACHASOV	98F	SND	$e^+e^- \to 7\gamma$
0.0118 ±0.0011	279	[23] AKHMETSHIN	95	CMD2	$e^+e^- \to \pi^+\pi^- 3\gamma$
0.0130 ±0.0006		[24] DRUZHININ	84	ND	$e^+e^- \to 3\gamma$
0.014 ±0.002		[25] 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	[24] COSME	76	OSPK	e^+e^-

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

0.01338±0.00012±0.00052	[26] ACHASOV	00	SND	$e^+e^- \to \eta\gamma$	
0.01287±0.00012±0.00042	[27] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$	
0.01259±0.00030±0.00059	[28] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$	
0.01343±0.00012±0.00055 23k	[22] ACHASOV	00D	SND	$e^+e^- \to \eta\gamma$	
0.0118 ±0.0003 ±0.0006 2200	[29] AKHMETSHIN	99F	CMD2	$e^+e^- \to \eta\gamma$	
0.0121 ±0.0007	[30] 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	[31] AKHMETSHIN	99B	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$

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

< 0.3	90	[32] 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	[33] 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
2.96±0.05 OUR FIT Error includes scale factor of 1.3.					
2.99±0.08 OUR AVERAGE Error includes scale factor of 1.2.					
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		[34] 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. • • •					
$1.226 \pm 0.036 \pm {}^{0.096}_{0.089}$		[35] ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$
1.26 ±0.17		[30] 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. • • •					
$0.71 \pm 0.11 \pm 0.09$		[18] ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$0.65 \pm {}^{0.38}_{0.29}$		[18] GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$2.01 \pm {}^{1.07}_{0.84}$		[18] 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 γ C $\to$ C$\pi^+\pi^-$

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

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
$5.2 \pm {}^{1.3}_{1.1}$	[36,37] 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	[38] ACHASOV	00E	SND	$e^+e^- \to \pi^0\pi^0\gamma$
$5.5 \pm {}^{1.6}_{1.4} \pm 0.3$	[37,39] AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
$4.8 \pm {}^{1.9}_{1.7} \pm 0.8$	[38] 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
$0.680 \pm {}^{0.021}_{0.019}$ OUR FIT Error includes scale factor of 1.3.					
0.740±0.031 OUR AVERAGE					
0.70 ±0.06	2732	BUKIN	78C	OLYA	$e^+e^- \to K^0_L K^0_S$
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		[40] 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
0.313±0.014 OUR FIT Error includes scale factor of 1.3.					
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
$\mathbf{1.3^{+0.8}_{-0.6}}$	7	GOLUBEV	85	ND	$e^+ e^- \to \gamma\gamma e^+ e^-$

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$6.7^{+1.5}_{-1.4}$ OUR FIT						
$6.7^{+3.4}_{-2.9}\pm1.0$		5	[41] AULCHENKO	99	SND	$e^+ e^- \to \pi^+\pi^- 3\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$8.2^{+2.1}_{-1.9}\pm1.1$		21	[42] AKHMETSHIN	00B	CMD2	$e^+ e^- \to \pi^+\pi^- 3\gamma$
$4.9^{+2.2}_{-1.8}\pm0.6$		9	[43] AKHMETSHIN	00F	CMD2	$e^+ e^- \to \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
6.4 ± 1.6		30	[44] AKHMETSHIN	00F	CMD2	$e^+ e^- \to \eta'(958)\gamma$
<11	90		AULCHENKO	98	SND	$e^+ e^- \to 7\gamma$
$12\ ^{+7}_{-5}\ \pm2$		6	[42] 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
$1.08\ \pm0.17\ \pm0.09$		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	[45,46] 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
$0.865\pm0.070\pm0.017$	419	[46] 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	$e^+ e^- \to 5\gamma$

$\Gamma(\pi^+\pi^+\pi^-\pi^-\pi^0)/\Gamma_{total}$ 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
$3.3\ ^{+0.8}_{-0.5}$ OUR FIT						
$2.90\pm0.21\pm1.54$			[47] 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	[45,48] ACHASOV	00H	SND	$e^+e^-\to\pi^0\pi^0\gamma$
$1.93\pm0.46\pm0.50$		27188	[49] AKHMETSHIN	99B	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
$3.05\pm0.25\pm0.72$		268	[50] AKHMETSHIN	99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
$1.5\ \pm0.5$		268	[51] AKHMETSHIN	99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
$3.42\pm0.30\pm0.36$		164	[48] ACHASOV	98I	SND	$e^+e^-\to5\gamma$
< 1	90		[52] AKHMETSHIN	97C	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
< 7	90		[53] 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
$2.6^{+0.6}_{-0.4}$ OUR FIT					
$2.6\pm0.2^{+0.8}_{-0.3}$	419	[48] ACHASOV	00H	SND	$e^+e^-\to\pi^0\pi^0\gamma$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.2\times10^{-4}$	90	DOLINSKY	88	ND	$e^+e^-\to\pi^0 e^+e^-$

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.89 ± 0.14 OUR AVERAGE						
$0.88\pm0.14\pm0.09$		36	[54] ACHASOV	00F	SND	$e^+e^-\to\eta\pi^0\gamma$
$0.90\pm0.24\pm0.10$		80	AKHMETSHIN	99C	CMD2	$e^+e^-\to\eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$0.83\pm0.23\pm0.12$		20	ACHASOV	98B	SND	$e^+e^-\to5\gamma$
<25	90		DOLINSKY	91	ND	$e^+e^-\to\pi^0\eta\gamma$

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<5	90		DOLINSKY	91	ND	$e^+e^- \to \pi^0\eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.88 ± 0.17		36	[55] ACHASOV	00F	SND	$e^+e^- \to \eta\pi^0\gamma$

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.0 ±0.4 OUR FIT					
$\mathbf{1.46^{+0.64}_{-0.54}\pm0.18}$	9	[56] 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
$\mathbf{5.1^{+1.2}_{-1.1}}$ **OUR FIT**					
$\mathbf{6.5^{+1.7}_{-1.5}\pm0.8}$	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	[57] 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	[49] 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	[58] 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	$e^+e^- \to \pi^+\pi^-\gamma\gamma$

[17] Using $\Gamma_{e^+e^-} = 1.32 \pm 0.04$ keV.

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

[19] 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.

[20] Neglecting interference between resonance and continuum.

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

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

[23] From $\pi^+\pi^-\pi^0$ decay mode of η.

[24] From 2γ decay mode of η.
[25] From $3\pi^0$ decay mode of η.
[26] From the $\eta \to 2\gamma$ decay and using B($\phi \to e^+e^-$) =(2.99 ± 0.08) × 10^{-4}.
[27] Using various decay modes of the η from ACHASOV 98F, ACHASOV 00, and ACHASOV 00B and B($\phi \to e^+e^-$) = (2.99 ± 0.08) × 10^{-4}.
[28] From the $\eta \to \pi^+\pi^-\pi^0$ decay and B($\phi \to e^+e^-$) = (2.99 ± 0.08) × 10^{-4}.
[29] From $\pi^+\pi^-\pi^0$ decay mode of η and using B($\phi \to e^+e^-$)= (2.99 ± 0.08) × 10^{-4}.
[30] Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.
[31] For $E_\gamma > 20$ MeV and assuming that B($\phi(1020) \to f_0(980)\gamma$) is neglibible. Supersedes AKHMETSHIN 97C.
[32] For $E_\gamma > 20$ MeV and assuming that B($\phi(1020) \to f_0(980)\gamma$) is negligible.
[33] Supersedes AKHMETSHIN 97C.
[34] 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.
[35] From the $\pi^0 \to 2\gamma$ decay and using B($\phi \to e^+e^-$) = (2.99 ± 0.08) × 10^{-4}.
[36] Using the 1996 and 1998 data.
[37] (2.3 ± 0.3)% correction for other decay modes of the $\omega(782)$ applied.
[38] Using the 1996 data.
[39] Using the 1998 data.
[40] Theoretical analysis of BRAMON 00 taking into account phase-space difference, electromagnetic radiatve corrections, as well as isospin breaking, predicts 0.62.
[41] Using the value B($\eta' \to \eta\pi^+\pi^-$)= (43.7 ± 1.5) × 10^{-2} and B($\eta \to \gamma\gamma$)= (39.25 ± 0.31) × 10^{-2}.
[42] Using the value B($\phi \to \eta\gamma$) = (1.26 ± 0.06) × 10^{-2}.
[43] Using B($\phi \to K^0_L K^0_S$) = (33.8 ± 0.6)%.
[44] Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.
[45] Using the value B($\phi \to \eta\gamma$)=(1.338 ± 0.053) × 10^{-2}.
[46] Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.
[47] From the combined fit of the photon spectra in the reactions $e^+e^- \to \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.
[48] 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($f_0 \to \pi^0\pi^0$).
[49] For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.
[50] Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).
[51] A narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
[52] For destructive interference with the Bremsstrahlung process
[53] For constructive interference with the Bremsstrahlung process
[54] Supersedes ACHASOV 98B.
[55] Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.
[56] 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.
[57] Superseded by AKHMETSHIN 00B.
[58] For $E_\gamma > 20$ MeV.

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$-0.16 < a_1 < 0.11$	90	[59] AKHMETSHIN 98	CMD2	$e^+e^- \to \pi^+\pi^-\gamma\gamma$

[59] 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.

ϕ(1020) REFERENCES

ACHASOV	00	EPJ C12 25	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	00B	JETP 90 17 Translated from ZHETF 117 22.	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	00C	PL B474 188	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	00D	JETPL 72 282 Translated from ZETFP 72 411.	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	00E	NP B569 158	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	00F	PL B479 53	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	00H	PL B485 349	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
AKHMETSHIN	00B	PL B473 337	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)
AKHMETSHIN	00E	PL B491 81	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)
AKHMETSHIN	00F	PL B494 26	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)
AULCHENKO	00A	JETP 90 927	V.M. Aulchenko *et al.*	
BRAMON	00	PL B486 406	A. Bramon *et al.*	
PDG	00	EPJ C15 1	D.E. Groom *et al.*	
ACHASOV	99	PL B449 122	M.N. Achasov *et al.*	
ACHASOV	99C	PL B456 304	M.N. Achasov *et al.*	
AKHMETSHIN	99B	PL B462 371	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)
AKHMETSHIN	99C	PL B462 380	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)
AKHMETSHIN	99D	PL B466 385	R.R. Akhmetshin *et al.*	
AKHMETSHIN	99F	PL B460 242	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)
AULCHENKO	99	JETPL 69 97 Translated from ZETFP 69 87.	V.M. Aulchenko *et al.*	
ACHASOV	98B	PL B438 441	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	98F	JETPL 68 573	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
ACHASOV	98I	PL B440 442	M.N. Achasov *et al.*	
AKHMETSHIN	98	PL B434 426	R.R. Akhmetshin *et al.*	
AULCHENKO	98	PL B436 199	V.M. Aulchenko *et al.*	
BARBERIS	98	PL B432 436	D. Barberis *et al.*	(Omega expt.)
AKHMETSHIN	97B	PL B415 445	R.R. Akhmetshin *et al.*	(NOVO, BOST, PITT+)
AKHMETSHIN	97C	PL B415 452	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)
BENAYOUN	96	ZPHY C72 221	M. Benayoun *et al.*	(IPNP, NOVO)
AKHMETSHIN	95	PL B364 199	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky *et al.*	(NOVO)
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky *et al.*	(NOVO)
BARKOV	88	SJNP 47 248 Translated from YAF 47 393.	L.M. Barkov *et al.*	(NOVO)
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DRUZHININ	87	ZPHY C37 1	V.P. Druzhinin *et al.*	(NOVO)
ARMSTRONG	86	PL 166B 245	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)
ATKINSON	86	ZPHY C30 521	M. Atkinson *et al.*	(BONN, CERN, GLAS+)
BEBEK	86	PRL 56 1893	C. Bebek *et al.*	(CLEO Collab.)
DAVENPORT	86	PR 33 2519	T.F. Davenport	(TUFTS, ARIZ, FNAL, FSU, NDAM+)
DIJKSTRA	86	ZPHY C31 375	H. Dijkstra *et al.*	(ANIK, BRIS, CERN+)
FRAME	86	NP B276 667	D. Frame *et al.*	(GLAS)
GOLUBEV	86	SJNP 44 409 Translated from YAF 44 633.	V.B. Golubev *et al.*	(NOVO)
ALBRECHT	85D	PL 153B 343	H. Albrecht *et al.*	(ARGUS Collab.)
GOLUBEV	85	SJNP 41 756 Translated from YAF 41 1183.	V.B. Golubev *et al.*	(NOVO)
DRUZHININ	84	PL 144B 136	V.P. Druzhinin *et al.*	(NOVO)
ARMSTRONG	83B	NP B224 193	T.A. Armstrong *et al.*	(BARI, BIRM, CERN+)
BARATE	83	PL 121B 449	R. Barate *et al.*	(SACL, LOIC, SHMP, IND)
KURDADZE	83C	JETPL 38 366 Translated from ZETFP 38 306.	L.M. Kurdadze *et al.*	(NOVO)

ARENTON	82	PR D25 2241	M.W. Arenton *et al.*	(ANL, ILL)
PELLINEN	82	PS 25 599	A. Pellinen, M. Roos	(HELS)
DAUM	81	PL 100B 439	C. Daum *et al.*	(AMST, BRIS, CERN, CRAC+)
IVANOV	81	PL 107B 297	P.M. Ivanov *et al.*	(NOVO)
Also	82	Private Comm.	S.I. Eidelman	(NOVO)
VASSERMAN	81	PL 99B 62	I.B. Vasserman *et al.*	(NOVO)
Also	82	SJNP 35 240	L.M. Kurdadze *et al.*	
		Translated from YAF 35 352.		
CORDIER	80	NP B172 13	A. Cordier *et al.*	(LALO)
CORDIER	79	PL 81B 389	A. Cordier *et al.*	(LALO)
BUKIN	78B	SJNP 27 521	A.D. Bukin *et al.*	(NOVO)
		Translated from YAF 27 985.		
BUKIN	78C	SJNP 27 516	A.D. Bukin *et al.*	(NOVO)
		Translated from YAF 27 976.		
COOPER	78B	NP B146 1	A.M. Cooper *et al.*	(TATA, CERN, CDEF+)
LOSTY	78	NP B133 38	M.J. Losty *et al.*	(CERN, AMST, NIJM+)
AKERLOF	77	PRL 39 861	C.W. Akerlof *et al.*	(FNAL, MICH, PURD)
ANDREWS	77	PRL 38 198	D.E. Andrews *et al.*	(ROCH)
BALDI	77	PL 68B 381	R. Baldi *et al.*	(GEVA)
CERRADA	77B	NP B126 241	M. Cerrada *et al.*	(AMST, CERN, NIJM+)
COHEN	77	PRL 38 269	D. Cohen *et al.*	(ANL)
LAVEN	77	NP B127 43	H. Laven *et al.*	(AACH3, BERL, CERN, LOIC+)
LYONS	77	NP B125 207	L. Lyons, A.M. Cooper, A.G. Clark	(OXF)
COSME	76	PL 63B 352	G. Cosme *et al.*	(ORSAY)
KALBFLEISCH	76	PR D13 22	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
PARROUR	76	PL 63B 357	G. Parrour *et al.*	(ORSAY)
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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)
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AUGUSTIN	73	PRL 30 462	J.E. Augustin *et al.*	(ORSAY)
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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)
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