$\phi(1020)$

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

$\phi(1020)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1019.461±0.019 OUR AVERAGE		Error includes scale factor of 1.1.			
1019.51 ±0.02 ±0.05		[1] LEES	13Q	BABR	$e^+e^- \to K^+K^-\gamma$
1019.30 ±0.02 ±0.10	105k	AKHMETSHIN	06	CMD2	0.98–1.06 $e^+e^- \to \pi^+\pi^-\pi^0$
1019.52 ±0.05 ±0.05	17.4k	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
1019.483±0.011±0.025	272k	[2] AKHMETSHIN	04	CMD2	$e^+e^- \to K_L^0 K_S^0$
1019.42 ±0.05	1900k	[3] 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		[4] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$
1019.38 ±0.07 ±0.08	2200	[5] 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	[6] 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. • • •					
1019.441±0.008±0.080	542k	[7] AKHMETSHIN	08	CMD2	1.02 $e^+e^- \to K^+K^-$
1019.63 ±0.07	12540	[8] AUBERT,B	05J	BABR	$D^0 \to \overline{K}^0 K^+K^-$
1019.8 ±0.7		ARMSTRONG	86	OMEG	85 $\pi^+/p p \to \pi^+/p 4Kp$
1020.1 ±0.11	5526	[8] ATKINSON	86	OMEG	20–70 γp
1019.7 ±1.0		BEBEK	86	CLEO	$e^+e^- \to \Upsilon(4S)$
1019.411±0.008	642k	[9] DIJKSTRA	86	SPEC	100–200 $\pi^\pm$, $\overline{p}$, p, $K^\pm$, on Be
1020.9 ±0.2		[8] FRAME	86	OMEG	13 $K^+p \to \phi K^+p$
1021.0 ±0.2		[8] ARMSTRONG	83B	OMEG	18.5 $K^-p \to K^-K^+\Lambda$
1020.0 ±0.5		[8] ARMSTRONG	83B	OMEG	18.5 $K^-p \to K^-K^+\Lambda$
1019.7 ±0.3		[8] 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	[8] 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	[10] AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \rightarrow \Lambda K^+ K^-$	
1019.9	±0.5	100	[10] 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 phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations.
[2] Update of AKHMETSHIN 99D
[3] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^-, $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.
[4] Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included.
[5] Using a total width of 4.43 ± 0.05 MeV.
[6] PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DEGROOT 74.
[7] Strongly correlated with AKHMETSHIN 04.
[8] Systematic errors not evaluated.
[9] Weighted and scaled average of 12 measurements of DIJKSTRA 86.
[10] 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*
4.266±0.031 OUR AVERAGE		Error includes scale factor of 1.2.			
4.29 ±0.04 ±0.07		[1] LEES	13Q	BABR	$e^+e^- \rightarrow K^+K^-\gamma$
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	[2] AKHMETSHIN	04	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
4.21 ±0.04	1900k	[3] 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	[4] IVANOV	81	OLYA	1–1.4 $e^+e^- \rightarrow K^+K^-$
4.3 ±0.6		[4] CORDIER	80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.36 ±0.29	3681	[4] BUKIN	78C	OLYA	$e^+e^- \rightarrow$ hadrons
4.4 ±0.6	984	[4] BESCH	74	CNTR	2 $\gamma p \rightarrow p K^+ K^-$
4.67 ±0.72	681	[4] 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. • • •

4.24	±0.02 ±0.03	542k	[5]	AKHMETSHIN	08	CMD2	1.02 $e^+e^- \to K^+K^-$
4.28	±0.13	12540	[6]	AUBERT,B	05J	BABR	$D^0 \to \overline{K}^0 K^+K^-$
4.45	±0.06	271k		DIJKSTRA	86	SPEC	100 π^- Be
3.6	±0.8	337	[4]	COOPER	78B	HBC	0.7–0.8 $\overline{p}p \to K^0_S K^0_L \pi^+\pi^-$
4.5	±0.50	1300	[4,6]	AKERLOF	77	SPEC	400 pA $\to K^+K^-$X
4.5	±0.8	500	[4,6]	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	[4]	BORENSTEIN	72	HBC	2.18 $K^- p \to K\overline{K}n$

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

[2] Update of AKHMETSHIN 99D

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

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

[5] Strongly correlated with AKHMETSHIN 04.

[6] Systematic errors not evaluated.

$\phi(1020)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	K^+K^-	(48.9 ±0.5) %	S=1.1
Γ_2	$K^0_L K^0_S$	(34.2 ±0.4) %	S=1.1
Γ_3	$\rho\pi + \pi^+\pi^-\pi^0$	(15.32 ±0.32) %	S=1.1
Γ_4	$\rho\pi$		
Γ_5	$\pi^+\pi^-\pi^0$		
Γ_6	$\eta\gamma$	(1.309±0.024) %	S=1.2
Γ_7	$\pi^0\gamma$	(1.27 ±0.06) $\times 10^{-3}$	
Γ_8	$\ell^+\ell^-$	—	
Γ_9	e^+e^-	(2.954±0.030) $\times 10^{-4}$	S=1.1
Γ_{10}	$\mu^+\mu^-$	(2.87 ±0.19) $\times 10^{-4}$	
Γ_{11}	ηe^+e^-	(1.15 ±0.10) $\times 10^{-4}$	
Γ_{12}	$\pi^+\pi^-$	(7.4 ±1.3) $\times 10^{-5}$	
Γ_{13}	$\omega\pi^0$	(4.7 ±0.5) $\times 10^{-5}$	
Γ_{14}	$\omega\gamma$	< 5 %	CL=84%
Γ_{15}	$\rho\gamma$	< 1.2 $\times 10^{-5}$	CL=90%
Γ_{16}	$\pi^+\pi^-\gamma$	(4.1 ±1.3) $\times 10^{-5}$	
Γ_{17}	$f_0(980)\gamma$	(3.22 ±0.19) $\times 10^{-4}$	S=1.1
Γ_{18}	$\pi^0\pi^0\gamma$	(1.13 ±0.06) $\times 10^{-4}$	
Γ_{19}	$\pi^+\pi^-\pi^+\pi^-$	(4.0 $^{+2.8}_{-2.2}$) $\times 10^{-6}$	

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}	$\pi^0\eta\gamma$		(7.27	$\pm$0.30)	$\times 10^{-5}$	S=1.5
Γ_{23}	$a_0(980)\gamma$		(7.6	$\pm$0.6)	$\times 10^{-5}$	
Γ_{24}	$K^0\overline{K}{}^0\gamma$		$<$ 1.9		$\times 10^{-8}$	CL=90%
Γ_{25}	$\eta'(958)\gamma$		(6.25	$\pm$0.21)	$\times 10^{-5}$	
Γ_{26}	$\eta\pi^0\pi^0\gamma$		$<$ 2		$\times 10^{-5}$	CL=90%
Γ_{27}	$\mu^+\mu^-\gamma$		(1.4	$\pm$0.5)	$\times 10^{-5}$	
Γ_{28}	$\rho\gamma\gamma$		$<$ 1.2		$\times 10^{-4}$	CL=90%
Γ_{29}	$\eta\pi^+\pi^-$		$<$ 1.8		$\times 10^{-5}$	CL=90%
Γ_{30}	$\eta\mu^+\mu^-$		$<$ 9.4		$\times 10^{-6}$	CL=90%
Γ_{31}	$\eta U \to \eta e^+ e^-$		$<$ 1		$\times 10^{-6}$	CL=90%

Lepton Family number (LF) violating modes

Γ_{32}	$e^\pm\mu^\mp$	*LF*	$<$ 2		$\times 10^{-6}$	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to 30 branching ratios uses 79 measurements and one constraint to determine 14 parameters. The overall fit has a $\chi^2 = 57.4$ for 66 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, $x_i \equiv \Gamma_i/\Gamma_{\rm total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	−72									
x_3	−53	−21								
x_6	−13	7	2							
x_7	−5	3	1	5						
x_9	30	−25	−10	−32	−15					
x_{10}	−4	3	1	3	2	−11				
x_{12}	−2	1	0	2	1	−5	1			
x_{13}	−2	2	1	2	1	−7	1	0		
x_{17}	0	0	0	0	0	0	0	0	0	
x_{18}	−6	4	2	17	3	−17	2	1	1	0
x_{19}	0	0	0	0	0	−1	0	0	0	0
x_{23}	0	0	0	0	0	0	0	0	0	0
x_{25}	−4	2	1	32	2	−10	1	1	1	0
	x_1	x_2	x_3	x_6	x_7	x_9	x_{10}	x_{12}	x_{13}	x_{17}

x_{19}	0		
x_{23}	0	0	
x_{25}	5	0	0
	x_{18}	x_{19}	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. • • •				
$58.9\pm0.5\pm2.4$	ACHASOV	00	SND	$e^+e^-\to\eta\gamma$

$\Gamma(\pi^0\gamma)$ Γ_7

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

$\Gamma(\ell^+\ell^-)$ Γ_8

VALUE (keV)	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.320\pm0.017\pm0.015$	[1] AMBROSINO	05	KLOE	1.02 $e^+e^-\to\mu^+\mu^-$

$\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	*DOCUMENT ID*		*TECN*	*COMMENT*
1.27 ±0.04 OUR EVALUATION				
1.251±0.021 OUR AVERAGE Error includes scale factor of 1.1.				
$1.235\pm0.006\pm0.022$	[2] AKHMETSHIN	11	CMD2	1.02 $e^+e^-\to\phi$
$1.32\ \pm0.05\ \pm0.03$	[3] AMBROSINO	05	KLOE	1.02 $e^+e^-\to e^+e^-$
$1.28\ \pm0.05$	AKHMETSHIN	95	CMD2	1.02 $e^+e^-\to\phi$

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

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

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

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

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

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

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

VALUE (keV)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.6340±0.0070±0.0039	[1] LEES	13Q	BABR	$e^+e^- \to K^+K^-\gamma$

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

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

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

VALUE (units 10^{-5})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
14.46±0.23 OUR FIT Error includes scale factor of 1.1.					
14.24±0.30 OUR AVERAGE					
14.27±0.05±0.31	542k	AKHMETSHIN	08	CMD2	1.02 $e^+e^- \to K^+K^-$
13.93±0.14±0.99	1000k	[1] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$

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

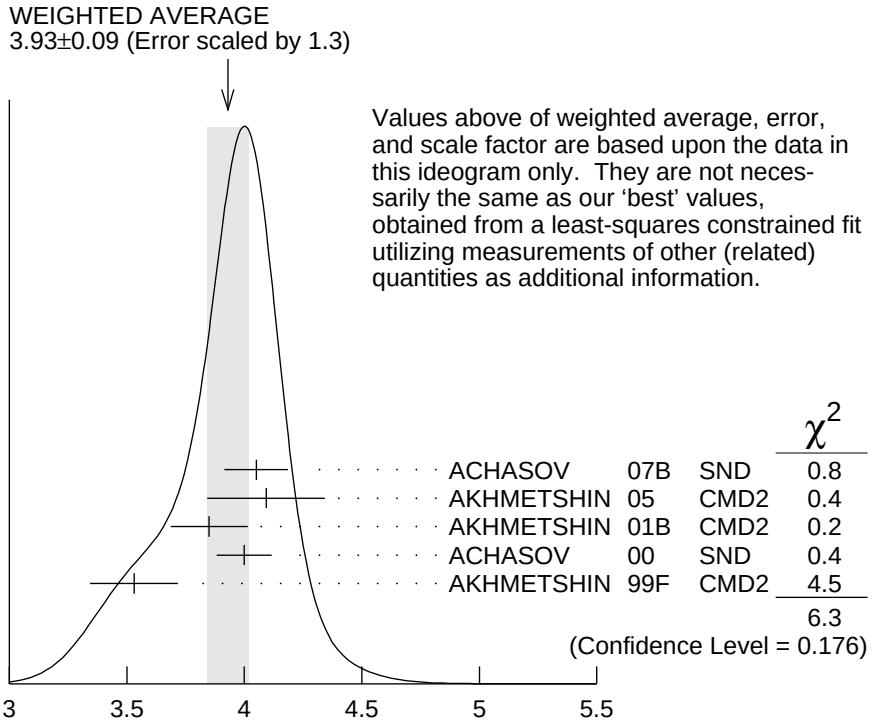
VALUE (units 10^{-5})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
10.10±0.13 OUR FIT					
10.06±0.16 OUR AVERAGE					
10.01±0.04±0.17	272k	[2] AKHMETSHIN	04	CMD2	$e^+e^- \to K^0_LK^0_S$
10.27±0.07±0.34	500k	[1] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$

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

VALUE (units 10^{-5})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.53 ±0.10 OUR FIT Error includes scale factor of 1.1.					
4.46 ±0.12 OUR AVERAGE					
4.51 ±0.16 ±0.11	105k	AKHMETSHIN	06	CMD2	0.98–1.06 $e^+e^- \to \pi^+\pi^-\pi^0$
4.30 ±0.08 ±0.21		AUBERT,B	04N	BABR	10.6 $e^+e^- \to \pi^+\pi^-\pi^0\gamma$
4.665±0.042±0.261	400k	[1] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$
4.35 ±0.27 ±0.08	11169	[3] AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.38 ±0.12		BENAYOUN	10	RVUE	0.4–1.05 e^+e^-

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

VALUE (units 10^{-6})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3.87 ±0.07 OUR FIT	Error includes scale factor of 1.2.				
3.93 ±0.09 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
$4.050 \pm 0.067 \pm 0.118$	33k	[4] ACHASOV	07B	SND	0.6–1.38 $e^+e^- \to \eta\gamma$
$4.093^{+0.040}_{-0.043} \pm 0.247$	17.4k	[5] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
$3.850 \pm 0.041 \pm 0.159$	23k	[6,7] AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
$4.00 \pm 0.04 \pm 0.11$		[8] ACHASOV	00	SND	$e^+e^- \to \eta\gamma$
$3.53 \pm 0.08 \pm 0.17$	2200	[9,10] AKHMETSHIN	99F	CMD2	$e^+e^- \to \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.19 ± 0.06		[11] BENAYOUN	10	RVUE	0.4–1.05 e^+e^-



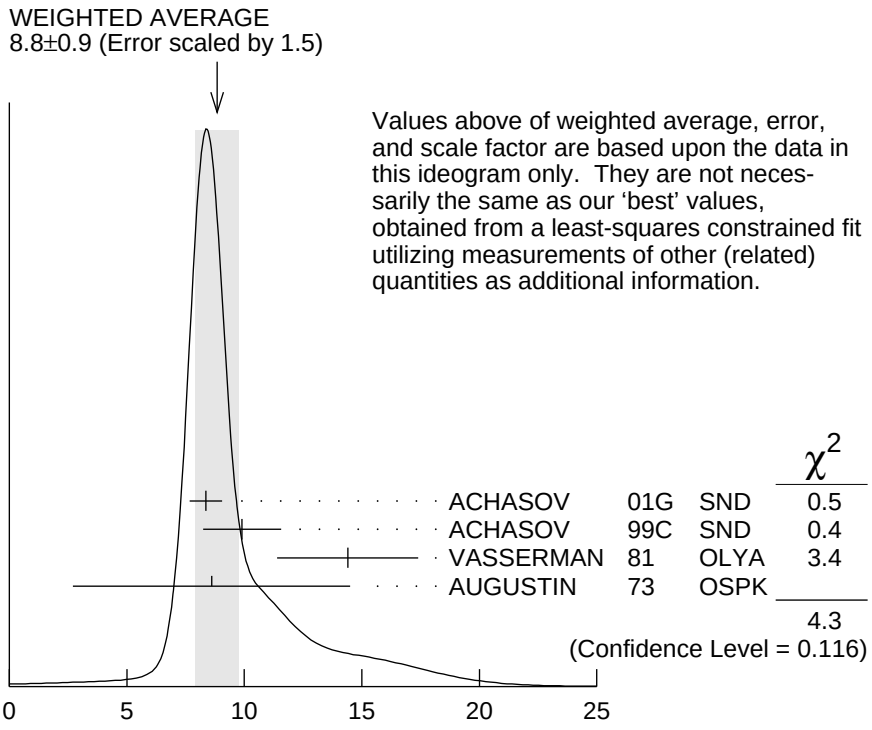
$\Gamma(\eta\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_6/\Gamma \times \Gamma_9/\Gamma$

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

VALUE (units 10^{-7})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3.74±0.18 OUR FIT					
3.71±0.21 OUR AVERAGE					
$3.75 \pm 0.11 \pm 0.29$	18680	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
$3.67 \pm 0.10^{+0.27}_{-0.25}$		[12] ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.29 ± 0.11		[11] BENAYOUN	10	RVUE	0.4–1.05 e^+e^-

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

VALUE (units 10^{-8})	*DOCUMENT ID*		*TECN*	*COMMENT*
$8.5\ ^{+0.5}_{-0.6}$ OUR FIT				
8.8 ±0.9 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.			
8.36±0.59±0.37	ACHASOV	01G	SND	$e^+e^- \to \mu^+\mu^-$
9.9 ±1.4 ±0.9	[9] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
14.4 ±3.0	[3] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
8.6 ±5.9	[3] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$



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

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

VALUE (units 10^{-8})	*DOCUMENT ID*		*TECN*	*COMMENT*
2.2 ±0.4 OUR FIT				
2.2 ±0.4 OUR AVERAGE				
2.1 ±0.3 ±0.3	[9] ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$1.95^{+1.15}_{-0.87}$	[3] GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$6.01^{+3.19}_{-2.51}$	[3] VASSERMAN	81	OLYA	$e^+e^- \to \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.31±0.99	[13] BENAYOUN	13	RVUE	0.4–1.05 e^+e^-

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

VALUE (units 10^{-8})	*DOCUMENT ID*		*TECN*	*COMMENT*
1.40±0.15 OUR FIT				
1.37±0.17±0.01	[14,15] AMBROSINO	08G	KLOE	$e^+e^- \to \pi^+\pi^- 2\pi^0$, $2\pi^0\gamma$

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

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
3.34±0.17 OUR FIT			
$3.33^{+0.04}_{-0.09}{}^{+0.19}_{-0.20}$	[16] AMBROSINO 07	KLOE	$e^+e^- \to \pi^0\pi^0\gamma$

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

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

[1] 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.
[2] Update of AKHMETSHIN 99D
[3] Recalculated by us from the cross section in the peak.
[4] 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 $B(\eta \to 3\pi^0)$ / $B(\eta \to \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.
[5] From the $\eta \to 2\gamma$ decay and using $B(\eta \to \gamma\gamma) = 39.43 \pm 0.26\%$.
[6] From the $\eta \to 3\pi^0$ decay and using $B(\eta \to 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
[7] 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).
[8] From the $\eta \to 2\gamma$ decay and using $B(\eta \to 2\gamma) = (39.21 \pm 0.34) \times 10^{-2}$.
[9] Recalculated by the authors from the cross section in the peak.
[10] From the $\eta \to \pi^+\pi^-\pi^0$ decay and using $B(\eta \to \pi^+\pi^-\pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.
[11] A simultaneous fit of $e^+e^- \to \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.
[12] From the $\pi^0 \to 2\gamma$ decay and using $B(\pi^0 \to 2\gamma) = (98.798 \pm 0.032) \times 10^{-2}$.
[13] A simultaneous fit to $e^+e^- \to \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$, $K\overline{K}$, and $\tau^- \to \pi^-\pi^0\nu_\tau$ data.
[14] Recalculated by the authors from the cross section at the peak.
[15] AMBROSINO 08G reports $[\Gamma(\phi(1020) \to \omega\pi^0)/\Gamma_{total} \times \Gamma(\phi(1020) \to e^+e^-)/\Gamma_{total}] \times [B(\omega(782) \to \pi^+\pi^-\pi^0)] = (1.22 \pm 0.13 \pm 0.08) \times 10^{-8}$ which we divide by our best value $B(\omega(782) \to \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
[16] Calculated by the authors from the cross section at the peak.

$\phi(1020)$ BRANCHING RATIOS

$\Gamma(K^+K^-)/\Gamma_{total}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.489±0.005 OUR FIT Error includes scale factor of 1.1.				
0.493±0.010 OUR AVERAGE				
0.492±0.012	2913	AKHMETSHIN 95	CMD2	$e^+e^- \to K^+K^-$
0.44 ±0.05	321	KALBFLEISCH 76	HBC	2.18 $K^-p \to \Lambda K^+K^-$
0.49 ±0.06	270	DEGROOT 74	HBC	4.2 $K^-p \to \Lambda\phi$
0.540±0.034	565	BALAKIN 71	OSPK	$e^+e^- \to K^+K^-$
0.48 ±0.04	252	LINDSEY 66	HBC	2.1–2.7 $K^-p \to \Lambda K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.493±0.003±0.007		[1] AKHMETSHIN 11	CMD2	1.02 $e^+e^- \to K^+K^-$
0.476±0.017	1000k	[2] ACHASOV 01E	SND	$e^+e^- \to K^+K^-$, K_SK_L, $\pi^+\pi^-\pi^0$

$\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.342±0.004 OUR FIT Error includes scale factor of 1.1.					
0.331±0.009 OUR AVERAGE					
0.335±0.010	40644	AKHMETSHIN	95	CMD2	$e^+e^- \to K_L^0 K_S^0$
0.326±0.035		DOLINSKY	91	ND	$e^+e^- \to K_L^0 K_S^0$
0.310±0.024		DRUZHININ	84	ND	$e^+e^- \to K_L^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.336±0.002±0.006		[1] AKHMETSHIN	11	CMD2	1.02 $e^+e^- \to K_S^0 K_L^0$
0.351±0.013	500k	[2] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
0.27 ±0.03	133	KALBFLEISCH	76	HBC	2.18 $K^- p \to \Lambda K_L^0 K_S^0$
0.257±0.030	95	BALAKIN	71	OSPK	$e^+e^- \to K_L^0 K_S^0$
0.40 ±0.04	167	LINDSEY	66	HBC	2.1–2.7 $K^- p \to \Lambda K_L^0 K_S^0$

$\Gamma(K_L^0 K_S^0)/\Gamma(K^+K^-)$ Γ_2/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.698±0.014 OUR FIT Error includes scale factor of 1.1.					
0.740±0.031 OUR AVERAGE					
0.70 ±0.06	2732	BUKIN	78C	OLYA	$e^+e^- \to K_L^0 K_S^0$
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		[3] AKHMETSHIN	95	CMD2	$e^+e^- \to K_L^0 K_S^0$, K^+K^-

$\Gamma(K_L^0 K_S^0)/\Gamma(K\overline{K})$ $\Gamma_2/(\Gamma_1+\Gamma_2)$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.411±0.005 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 $K^- p \to \Lambda K\overline{K}$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.1532±0.0032 OUR FIT Error includes scale factor of 1.1.					
0.151 ±0.009 OUR AVERAGE Error includes scale factor of 1.7.					
0.161 ±0.008	11761	AKHMETSHIN	95	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
0.143 ±0.007		DOLINSKY	91	ND	$e^+e^- \to \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.155 ±0.002 ±0.005		[1] AKHMETSHIN	11	CMD2	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
0.159 ±0.008	400k	[2] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
0.145 ±0.009 ±0.003	11169	[4] AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
0.139 ±0.007		[5] PARROUR	76B	OSPK	e^+e^-

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.313±0.009 OUR FIT	Error includes scale factor of 1.1.				
0.28 ±0.09	34	AGUILAR-...	72B	HBC	3.9,4.6 K^-p

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.184±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	$e^+e^- \to \pi^+\pi^-\pi^0$

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

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
≃ 0.0087		1.98M	[6,7] ALOISIO	03	KLOE	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
<0.0006	90		[8] ACHASOV	02	SND	1.02 $e^+e^- \to \pi^+\pi^-\pi^0$
<0.23	90		[8] CORDIER	80	DM1	$e^+e^- \to \pi^+\pi^-\pi^0$
<0.20	90		[8] PARROUR	76B	OSPK	$e^+e^- \to \pi^+\pi^-\pi^0$

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.309±0.024 OUR FIT	Error includes scale factor of 1.2.				
1.26 ±0.04 OUR AVERAGE					
1.246±0.025±0.057	10k	[9] ACHASOV	98F	SND	$e^+e^- \to 7\gamma$
1.18 ±0.11	279	[10] AKHMETSHIN	95	CMD2	$e^+e^- \to \pi^+\pi^-3\gamma$
1.30 ±0.06		[11] DRUZHININ	84	ND	$e^+e^- \to 3\gamma$
1.4 ±0.2		[12] DRUZHININ	84	ND	$e^+e^- \to 6\gamma$
0.88 ±0.20	290	KURDADZE	83C	OLYA	$e^+e^- \to 3\gamma$
1.35 ±0.29		ANDREWS	77	CNTR	6.7–10 γCu
1.5 ±0.4	54	[11] COSME	76	OSPK	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.38 ±0.02 ±0.02		[1] AKHMETSHIN	11	CMD2	1.02 $e^+e^- \to \eta\gamma$
1.37 ±0.05 ±0.01	33k	[13] ACHASOV	07B	SND	0.6–1.38 $e^+e^- \to \eta\gamma$
1.373±0.014±0.085	17.4k	[14,15] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
1.287±0.013±0.063		[16,17] AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
1.338±0.012±0.052		[18] ACHASOV	00	SND	$e^+e^- \to \eta\gamma$
1.18 ±0.03 ±0.06	2200	[19] AKHMETSHIN	99F	CMD2	$e^+e^- \to \eta\gamma$
1.21 ±0.07		[20] BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \to \eta\gamma$

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.27 ±0.06 OUR FIT					
1.31 ±0.13 OUR AVERAGE					
1.30 ±0.13		DRUZHININ	84	ND	$e^+e^- \to 3\gamma$
1.4 ±0.5	32	COSME	76	OSPK	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.258±0.037±0.077	18680	[21,22] AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \pi^0\gamma$
$1.226\pm0.036^{+0.096}_{-0.089}$		[23] ACHASOV	00	SND	$e^+e^- \to \pi^0\gamma$
1.26 ±0.17		[20] BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \to \pi^0\gamma$

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

$\Gamma(e^+e^-)/\Gamma_{total}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.954±0.030 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	[24] 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^- → hadrons
3.00 ±0.21	3681	BUKIN	78C	OLYA	e^+e^- → hadrons
3.10 ±0.14		[25] PARROUR	76	OSPK	e^+e^-
3.3 ±0.3		COSME	74	OSPK	e^+e^- → hadrons
2.81 ±0.25	681	BALAKIN	71	OSPK	e^+e^- → hadrons
3.50 ±0.27		CHATELUS	71	OSPK	e^+e^-

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

VALUE (units 10^{-4})	DOCUMENT ID		TECN	COMMENT
2.87±0.19 OUR FIT				
2.5 ±0.4 OUR AVERAGE				
2.69±0.46	[26] HAYES	71	CNTR	8.3,9.8 $\gamma C \to \mu^+\mu^- X$
2.17±0.60	[26] 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	[27] ACHASOV	01G	SND	$e^+e^- \to \mu^+\mu^-$
3.30±0.45±0.32	[4] ACHASOV	99C	SND	$e^+e^- \to \mu^+\mu^-$
4.83±1.02	[28] VASSERMAN	81	OLYA	$e^+e^- \to \mu^+\mu^-$
2.87±1.98	[28] AUGUSTIN	73	OSPK	$e^+e^- \to \mu^+\mu^-$

$\Gamma(\eta e^+e^-)/\Gamma_{total}$ 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	[29] ACHASOV	01B	SND	$e^+e^- \to \gamma\gamma e^+e^-$
1.14±0.10±0.06	355	[30] 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. • • •

$1.13 \pm 0.14 \pm 0.07$	183	[31] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
$1.21 \pm 0.14 \pm 0.09$	130	[32] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$
$1.04 \pm 0.20 \pm 0.08$	42	[33] AKHMETSHIN	01	CMD2	$e^+e^- \to \eta e^+e^-$

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

VALUE (units 10^{-4})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.71 \pm 0.11 \pm 0.09$		[4] ACHASOV	00C	SND	$e^+e^- \to \pi^+\pi^-$
$0.65^{+0.38}_{-0.29}$		[4] GOLUBEV	86	ND	$e^+e^- \to \pi^+\pi^-$
$2.01^{+1.07}_{-0.84}$		[4] 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	$6.7\ \gamma C \to C\pi^+\pi^-$

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

VALUE (units 10^{-5})	*DOCUMENT ID*		*TECN*	*COMMENT*
4.7 ± 0.5 OUR FIT				
$\mathbf{5.2^{+1.3}_{-1.1}}$	[34,35] AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.4 ± 0.6	[36] AMBROSINO	08G	KLOE	$e^+e^- \to \pi^+\pi^- 2\pi^0,\ 2\pi^0\gamma$
~ 5.4	[37] ACHASOV	00E	SND	$e^+e^- \to \pi^0\pi^0\gamma$
$5.5^{+1.6}_{-1.4} \pm 0.3$	[35,38] AULCHENKO	00A	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
$4.8^{+1.9}_{-1.7} \pm 0.8$	[37] ACHASOV	99	SND	$e^+e^- \to \pi^+\pi^-\pi^0\pi^0$

$\Gamma(\omega\gamma)/\Gamma_{\text{total}}$ 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	[39] 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

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

VALUE (units 10^{-4})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$0.41 \pm 0.12 \pm 0.04$		30175	[40] AKHMETSHIN	99B	CMD2	$e^+e^- \to \pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 0.3	90		[41] 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

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
3.22±0.19 OUR FIT Error includes scale factor of 1.1.						
3.21±0.19 OUR AVERAGE						
$3.21^{+0.03}_{-0.09}\pm0.18$			[42] AMBROSINO	07	KLOE	$e^+e^-\to\pi^0\pi^0\gamma$
$2.90\pm0.21\pm1.54$			[43] 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	[44] ALOISIO	02D	KLOE	$e^+e^-\to\pi^0\pi^0\gamma$
$3.5\ \pm0.3\ ^{+1.3}_{-0.5}$		419	[45,46] ACHASOV	00H	SND	$e^+e^-\to\pi^0\pi^0\gamma$
$1.93\pm0.46\pm0.50$		27188	[47] AKHMETSHIN	99B	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
$3.05\pm0.25\pm0.72$		268	[48] AKHMETSHIN	99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
$1.5\ \pm0.5$		268	[49] AKHMETSHIN	99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
$3.42\pm0.30\pm0.36$		164	[45] ACHASOV	98I	SND	$e^+e^-\to5\gamma$
<1	90		[50] AKHMETSHIN	97C	CMD2	$e^+e^-\to\pi^+\pi^-\gamma$
<7	90		[51] 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
2.46±0.15 OUR FIT Error includes scale factor of 1.1.					
2.6 ±0.2 $^{+0.8}_{-0.3}$	419	[45] ACHASOV	00H	SND	$e^+e^-\to\pi^0\pi^0\gamma$

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.07 ±0.06 OUR AVERAGE						
$1.07\ ^{+0.01}_{-0.03}\ ^{+0.06}_{-0.06}$			[52] AMBROSINO	07	KLOE	$e^+e^-\to\pi^0\pi^0\gamma$
$1.08\ \pm0.17\ \pm0.09$		268	AKHMETSHIN	99C	CMD2	$e^+e^-\to\pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$1.09\ \pm0.03\ \pm0.05$		2438	ALOISIO	02D	KLOE	$e^+e^-\to\pi^0\pi^0\gamma$
$1.158\pm0.093\pm0.052$		419	[46,53] ACHASOV	00H	SND	$e^+e^-\to\pi^0\pi^0\gamma$
<10	90		DRUZHININ	87	ND	$e^+e^-\to5\gamma$

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.86 ±0.04 OUR FIT					
0.865±0.070±0.017	419	[53] 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	$e^+e^-\to5\gamma$

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

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

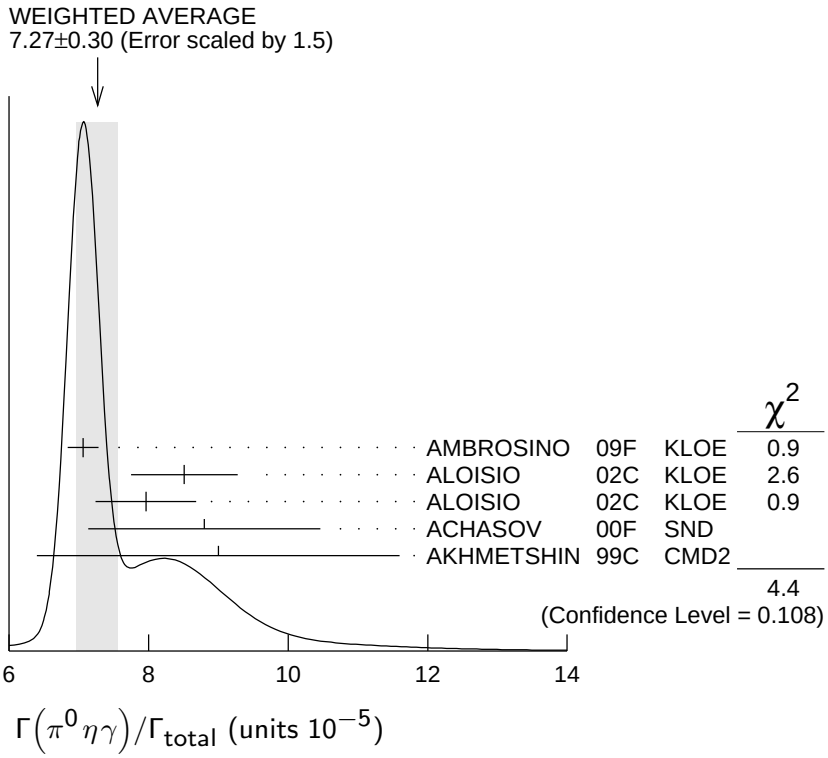
VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
< 4.6	90	AKHMETSHIN	00E	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<150	95	BARKOV	88	CMD	$e^+e^- \to \pi^+\pi^-\pi^+\pi^-\pi^0$

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.12±0.28 OUR AVERAGE						
1.01±0.28±0.29		52	[54] ACHASOV	02D	SND	$e^+e^- \to \pi^0 e^+ e^-$
1.22±0.34±0.21		46	[55] AKHMETSHIN	01C	CMD2	$e^+e^- \to \pi^0 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<12	90		DOLINSKY	88	ND	$e^+e^- \to \pi^0 e^+ e^-$

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
7.27±0.30 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.						
7.06±0.22		16.9k	[56] AMBROSINO	09F	KLOE	$1.02\ e^+e^- \to \eta\pi^0\gamma$
8.51±0.51±0.57		607	[57] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
7.96±0.60±0.40		197	[58] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
8.8 ±1.4 ±0.9		36	[59] ACHASOV	00F	SND	$e^+e^- \to \eta\pi^0\gamma$
9.0 ±2.4 ±1.0		80	AKHMETSHIN	99C	CMD2	$e^+e^- \to \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
7.01±0.10±0.20		13.3k	[57,60] AMBROSINO	09F	KLOE	$1.02\ e^+e^- \to \eta\pi^0\gamma$
7.12±0.13±0.22		3.6k	[58,61] AMBROSINO	09F	KLOE	$1.02\ e^+e^- \to \eta\pi^0\gamma$
8.3 ±2.3 ±1.2		20	ACHASOV	98B	SND	$e^+e^- \to 5\gamma$
<250	90		DOLINSKY	91	ND	$e^+e^- \to \pi^0\eta\gamma$



$\Gamma(a_0(980)\gamma)/\Gamma_{total}$ 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			[62] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$
8.8±1.7		36	[63] ACHASOV	00F	SND	$e^+e^- \to \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
11 ±2			[64] 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	[65] ALOISIO	02C	KLOE	$e^+e^- \to \eta\pi^0\gamma$

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

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

$\Gamma(\eta'(958)\gamma)/\Gamma_{total}$ Γ_{25}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
6.25±0.21 OUR FIT						
6.25±0.30 OUR AVERAGE						
6.25±0.28±0.11		3407	[66] AMBROSINO	07A	KLOE	1.02 $e^+e^- \to \pi^+\pi^-7\gamma$
6.7 $^{+2.8}_{-2.4}$ ±0.8		12	[67] AULCHENKO	03B	SND	$e^+e^- \to \eta'\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
6.7 $^{+5.0}_{-4.2}$ ±1.5		7	AULCHENKO	03B	SND	$e^+e^- \to 7\gamma$
6.10±0.61±0.43		120	[68] ALOISIO	02E	KLOE	1.02 $e^+e^- \to \pi^+\pi^-3\gamma$
8.2 $^{+2.1}_{-1.9}$ ±1.1		21	[69] AKHMETSHIN	00B	CMD2	$e^+e^- \to \pi^+\pi^-3\gamma$
4.9 $^{+2.2}_{-1.8}$ ±0.6		9	[70] AKHMETSHIN	00F	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
6.4 ±1.6		30	[71] AKHMETSHIN	00F	CMD2	$e^+e^- \to \eta'(958)\gamma$
6.7 $^{+3.4}_{-2.9}$ ±1.0		5	[72] AULCHENKO	99	SND	$e^+e^- \to \pi^+\pi^-3\gamma$
<11	90		AULCHENKO	98	SND	$e^+e^- \to 7\gamma$
12 $^{+7}_{-5}$ ±2		6	[69] AKHMETSHIN	97B	CMD2	$e^+e^- \to \pi^+\pi^-\ 3\gamma$
<41	90		DRUZHININ	87	ND	$e^+e^- \to \gamma\eta\pi^+\pi^-$

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.83±0.06 OUR FIT					
1.46 $^{+0.64}_{-0.54}$ ±0.18	9	[73] AKHMETSHIN	00F	CMD2	$e^+e^- \to \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$

$\Gamma(\eta'(958)\gamma)/\Gamma(\eta\gamma)$ Γ_{25}/Γ_6

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
4.77±0.15 OUR FIT					
4.78±0.20 OUR AVERAGE					
4.77±0.09±0.19	3407	AMBROSINO	07A	KLOE	1.02 $e^+e^- \to \pi^+\pi^- 7\gamma$
4.70±0.47±0.31	120	[74] 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	[75] AKHMETSHIN	97B	CMD2	$e^+e^- \to \pi^+\pi^- 3\gamma$

$\Gamma(\eta\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ

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

$\Gamma(\mu^+\mu^-\gamma)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
1.43±0.45±0.14	27188	[47] 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	[76] AKHMETSHIN	97C	CMD2	$e^+e^- \to \mu^+\mu^-\gamma$

$\Gamma(\rho\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{28}/Γ

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

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

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

$\Gamma(\eta\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

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

$\Gamma(\eta U \to \eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1\times10^{-6}$	90	[77] BABUSCI	13B	KLOE	1.02 $e^+e^- \to \eta e^+e^-$

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

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

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

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

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

[6] From a fit without limitations on charged and neutral ρ masses and widths.

[7] Adding the direct and $\omega\pi$ contributions and considering the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

[8] Neglecting the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

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

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

[11] From 2γ decay mode of η.

[12] From $3\pi^0$ decay mode of η.

[13] ACHASOV 07B reports [Γ(ϕ(1020) → $\eta\gamma$)/Γ_{total}] × [B(ϕ(1020) → e^+e^-)] = (4.050 ± 0.067 ± 0.118) × 10^{-6} which we divide by our best value B(ϕ(1020) → e^+e^-) = (2.954 ± 0.030) × 10^{-4}. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.

[14] Using B($\phi \to e^+e^-$) = (2.98 ± 0.04) × 10^{-4} and B($\eta \to \gamma\gamma$) = 39.43 ± 0.26%.

[15] Not independent of the corresponding Γ(e^+e^-) × Γ($\eta\gamma$)/Γ^2_{total}.

[16] Using B($\phi \to e^+e^-$) = (2.99 ± 0.08) × 10^{-4} and B($\eta \to 3\pi^0$)=(32.24 ± 0.29) × 10^{-2}.

[17] The combined fit from 600 to 1380 MeV taking into account ρ(770), ω(782), ϕ(1020), and ρ(1450) (mass and width fixed at 1450 MeV and 310 MeV respectively).

[18] From the $\eta \to 2\gamma$ decay and using B($\phi \to e^+e^-$) =(2.99 ± 0.08) × 10^{-4}.

[19] From $\pi^+\pi^-\pi^0$ decay mode of η and using B($\phi \to e^+e^-$)= (2.99 ± 0.08) × 10^{-4}.

[20] Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

[21] Using B($\phi \to e^+e^-$) = (2.98 ± 0.04) × 10^{-4}.

[22] Not independent of the corresponding Γ(e^+e^-) × Γ($\pi^0\gamma$)/Γ^2_{total}.

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

[24] From the combined fit assuming that the total ϕ(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.

[25] 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.

[26] Neglecting interference between resonance and continuum.

[27] Using B($\phi \to e^+e^-$) = (2.91 ± 0.07) × 10^{-4}.

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

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

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

[31] From $\eta \to \gamma\gamma$ decays and using B($\eta \to \gamma\gamma$) = (39.33 ± 0.25) × 10^{-2}, B($\eta \to \pi^+\pi^-\gamma$) = (4.75 ± 11) × 10^{-2}, and B($\phi \to \eta\gamma$) = (1.297 ± 0.033) × 10^{-2}.

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

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

[34] Using the 1996 and 1998 data.

[35] (2.3 ± 0.3)% correction for other decay modes of the $\omega(782)$ applied.

[36] Not independent of the corresponding $\Gamma(\omega\pi^0) \times \Gamma(e^+e^-) / \Gamma^2(\text{total})$.

[37] Using the 1996 data.

[38] Using the 1998 data.

[39] Supersedes AKHMETSHIN 97C.

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

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

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

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

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

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

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

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

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

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

[50] For destructive interference with the Bremsstrahlung process

[51] For constructive interference with the Bremsstrahlung process

[52] Supersedes ALOISIO 02D.

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

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

[55] 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 $B(\eta \to \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$.

[56] Combined results of $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decay modes measurements.

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

[58] From the decay mode $\eta \to \pi^+\pi^-\pi^0$.

[59] Supersedes ACHASOV 98B.

[60] Using $B(\phi \to \eta\gamma) = (1.304 \pm 0.025)$%, $B(\eta \to 3\pi^0) = (32.56 \pm 0.23)$%, and $B(\eta \to \gamma\gamma) = (39.31 \pm 0.20)$%.

[61] Using $B(\phi \to \eta\gamma) = (1.304 \pm 0.025)$%, $B(\eta \to 3\pi^0) = (32.56 \pm 0.23)$%, and $B(\eta \to \pi^+\pi^-\pi^0) = (22.73 \pm 0.28)$%.

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

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

[64] Using data of ACHASOV 00F.

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

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

$(1.309 \pm 0.024) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[67] Averaging AULCHENKO 03B with AULCHENKO 99.

[68] Using B($\phi \rightarrow \eta\gamma$)= (1.297 ± 0.033)%.

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

[70] Using B($\phi \rightarrow K_L^0 K_S^0$) = (33.8 ± 0.6)%.

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

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

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

[74] From the decay mode $\eta' \rightarrow \eta\pi^+\pi^-$, $\eta \rightarrow \gamma\gamma$.

[75] Superseded by AKHMETSHIN 00B.

[76] For $E_\gamma > 20$ MeV.

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

Lepton Family number (LF) violating modes

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

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

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

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

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

[1] Dalitz plot analysis taking into account interference between the contact and $\rho\pi$ amplitudes.

[2] From a fit without limitations on charged and neutral ρ masses and widths.

[3] Recalculated by us to match the notations of AKHMETSHIN 98.

[4] Assuming zero phase for the contact term.

ϕ(1020) REFERENCES

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AKHMETSHIN 08 PL B669 217 R.R. Akhmetshin *et al.* (CMD-2 Collab.)
AMBROSINO 08G PL B669 223 F. Ambrosino *et al.* (KLOE Collab.)
AULCHENKO 08 JETPL 88 85 V. Aulchenko *et al.* (CMD-2 Collab.)
Translated from ZETFP 88 93.
FLOREZ-BAEZ 08 PR D78 077301 F.V. Florez-Baez, G. Lopez Castro
ACHASOV 07B PR D76 077101 M.N. Achasov *et al.* (SND Collab.)
AMBROSINO 07 EPJ C49 473 F. Ambrosino *et al.* (KLOE Collab.)
AMBROSINO 07A PL B648 267 F. Ambrosino *et al.* (KLOE Collab.)
DUBYNSKIY 07 PR D75 113001 S. Dubynskiy *et al.*
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.)
AUBERT,B 04N PR D70 072004 B. Aubert *et al.* (BABAR Collab.)
ALOISIO 03 PL B561 55 A. Aloisio *et al.* (KLOE Collab.)
AULCHENKO 03B JETP 97 24 V.M. Aulchenko *et al.* (Novosibirsk SND Collab.)
Translated from ZETF 124 28.
ACHASOV 02 PR D65 032002 M.N. Achasov *et al.* (Novosibirsk SND Collab.)
ACHASOV 02D JETPL 75 449 M.N. Achasov *et al.* (Novosibirsk SND Collab.)
Translated from ZETFP 75 539.
ALOISIO 02C PL B536 209 A. Aloisio *et al.* (KLOE Collab.)
ALOISIO 02D PL B537 21 A. Aloisio *et al.* (KLOE Collab.)
ALOISIO 02E PL B541 45 A. Aloisio *et al.* (KLOE Collab.)
FISCHBACH 02 PL B526 355 E. Fischbach, A.W. Overhauser, B. Woodahl
GOKALP 02 JP G28 2783 A. Gokalp *et al.*
ACHASOV 01B PL B504 275 M.N. Achasov *et al.* (Novosibirsk SND Collab.)
ACHASOV 01E PR D63 072002 M.N. Achasov *et al.* (Novosibirsk SND Collab.)
ACHASOV 01F PR D63 094007 N.N. Achasov, V.V. Gubin (Novosibirsk SND Collab.)
ACHASOV 01G PRL 86 1698 M.N. Achasov *et al.* (Novosibirsk SND Collab.)
AITALA 01B PRL 86 770 E.M. Aitala *et al.* (FNAL E791 Collab.)
AKHMETSHIN 01 PL B501 191 R.R. Akhmetshin *et al.* (Novosibirsk CMD-2 Collab.)
AKHMETSHIN 01B PL B509 217 R.R. Akhmetshin *et al.* (Novosibirsk CMD-2 Collab.)
AKHMETSHIN 01C PL B503 237 R.R. Akhmetshin *et al.* (Novosibirsk CMD-2 Collab.)
BENAYOUN 01 EPJ C22 503 M. Benayoun, H.B. O'Connell
ACHASOV 00 EPJ C12 25 M.N. Achasov *et al.* (Novosibirsk SND Collab.)
ACHASOV 00B JETP 90 17 M.N. Achasov *et al.* (Novosibirsk SND Collab.)
Translated from ZETF 117 22.
ACHASOV 00C PL B474 188 M.N. Achasov *et al.* (Novosibirsk SND Collab.)
ACHASOV 00D JETPL 72 282 M.N. Achasov *et al.* (Novosibirsk SND Collab.)
Translated from ZETFP 72 411.
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.* (Novosibirsk CMD-2 Collab.)
AKHMETSHIN 00E PL B491 81 R.R. Akhmetshin *et al.* (Novosibirsk CMD-2 Collab.)
AKHMETSHIN 00F PL B494 26 R.R. Akhmetshin *et al.* (Novosibirsk CMD-2 Collab.)
AULCHENKO 00A JETP 90 927 V.M. Aulchenko *et al.* (Novosibirsk SND Collab.)
Translated from ZETF 117 1067.
BRAMON 00 PL B486 406 A. Bramon *et al.*
PDG 00 EPJ C15 1 D.E. Groom *et al.* (PDG Collab.)
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.* (Novosibirsk CMD-2 Collab.)
AKHMETSHIN 99C PL B462 380 R.R. Akhmetshin *et al.* (Novosibirsk CMD-2 Collab.)
AKHMETSHIN 99D PL B466 385 R.R. Akhmetshin *et al.*
Also PL B508 217 (errat) R.R. Akhmetshin *et al.* (Novosibirsk CMD-2 Collab.)
AKHMETSHIN 99F PL B460 242 R.R. Akhmetshin *et al.* (Novosibirsk CMD-2 Collab.)

AULCHENKO	99	JETPL 69 97	V.M. Aulchenko *et al.*	
		Translated from ZETFP 69 87.		
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.*	(CMD-2 Collab.)
AULCHENKO	98	PL B436 199	V.M. Aulchenko *et al.*	(Novosibirsk SND Collab.)
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.*	(Novosibirsk CMD-2 Collab.)
BENAYOUN	96	ZPHY C72 221	M. Benayoun *et al.*	(IPNP, NOVO)
AKHMETSHIN	95	PL B364 199	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky *et al.*	(NOVO)
KUHN	90	ZPHY C48 445	J.H. Kuhn *et al.*	(MPIM)
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky *et al.*	(NOVO)
BARKOV	88	SJNP 47 248	L.M. Barkov *et al.*	(NOVO)
		Translated from YAF 47 393.		
DOLINSKY	88	SJNP 48 277	S.I. Dolinsky *et al.*	(NOVO)
		Translated from YAF 48 442.		
DRUZHININ	87	ZPHY C37 1	V.P. Druzhinin *et al.*	(NOVO)
ARMSTRONG	86	PL 166B 245	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)
ATKINSON	86	ZPHY C30 521	M. Atkinson *et al.*	(BONN, CERN, GLAS+)
BEBEK	86	PRL 56 1893	C. Bebek *et al.*	(CLEO Collab.)
DAVENPORT	86	PR D33 2519	T.F. Davenport	(TUFTS, ARIZ, FNAL, FSU, NDAM+)
DIJKSTRA	86	ZPHY C31 375	H. Dijkstra *et al.*	(ANIK, BRIS, CERN+)
FRAME	86	NP B276 667	D. Frame *et al.*	(GLAS)
GOLUBEV	86	SJNP 44 409	V.B. Golubev *et al.*	(NOVO)
		Translated from YAF 44 633.		
ALBRECHT	85D	PL 153B 343	H. Albrecht *et al.*	(ARGUS Collab.)
GOLUBEV	85	SJNP 41 756	V.B. Golubev *et al.*	(NOVO)
		Translated from YAF 41 1183.		
DRUZHININ	84	PL 144B 136	V.P. Druzhinin *et al.*	(NOVO)
ARMSTRONG	83B	NP B224 193	T.A. Armstrong *et al.*	(BARI, BIRM, CERN+)
BARATE	83	PL 121B 449	R. Barate *et al.*	(SACL, LOIC, SHMP, IND)
KURDADZE	83C	JETPL 38 366	L.M. Kurdadze *et al.*	(NOVO)
		Translated from ZETFP 38 306.		
ARENTON	82	PR D25 2241	M.W. Arenton *et al.*	(ANL, ILL)
PELLINEN	82	PS 25 599	A. Pellinen, M. Roos	(HELS)
DAUM	81	PL 100B 439	C. Daum *et al.*	(AMST, BRIS, CERN, CRAC+)
IVANOV	81	PL 107B 297	P.M. Ivanov *et al.*	(NOVO)
Also		Private Comm.	S.I. Eidelman	(NOVO)
VASSERMAN	81	PL 99B 62	I.B. Vasserman *et al.*	(NOVO)
Also		SJNP 35 240	L.M. Kurdadze *et al.*	
		Translated from YAF 35 352.		
CORDIER	80	NP B172 13	A. Cordier *et al.*	(LALO)
CORDIER	79	PL 81B 389	A. Cordier *et al.*	(LALO)
BUKIN	78B	SJNP 27 521	A.D. Bukin *et al.*	(NOVO)
		Translated from YAF 27 985.		
BUKIN	78C	SJNP 27 516	A.D. Bukin *et al.*	(NOVO)
		Translated from YAF 27 976.		
COOPER	78B	NP B146 1	A.M. Cooper *et al.*	(TATA, CERN, CDEF+)
LOSTY	78	NP B133 38	M.J. Losty *et al.*	(CERN, AMST, NIJM+)
AKERLOF	77	PRL 39 861	C.W. Akerlof *et al.*	(FNAL, MICH, PURD)
ANDREWS	77	PRL 38 198	D.E. Andrews *et al.*	(ROCH)
BALDI	77	PL 68B 381	R. Baldi *et al.*	(GEVA)
CERRADA	77B	NP B126 241	M. Cerrada *et al.*	(AMST, CERN, NIJM+)
COHEN	77	PRL 38 269	D. Cohen *et al.*	(ANL)
LAVEN	77	NP B127 43	H. Laven *et al.*	(AACH3, BERL, CERN, LOIC+)
LYONS	77	NP B125 207	L. Lyons, A.M. Cooper, A.G. Clark	(OXF)
COSME	76	PL 63B 352	G. Cosme *et al.*	(ORSAY)
KALBFLEISCH	76	PR D13 22	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
PARROUR	76	PL 63B 357	G. Parrour *et al.*	(ORSAY)
PARROUR	76B	PL 63B 362	G. Parrour *et al.*	(ORSAY)
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
AYRES	74	PRL 32 1463	D.S. Ayres *et al.*	(ANL)
BESCH	74	NP B70 257	H.J. Besch *et al.*	(BONN)
COSME	74	PL 48B 155	G. Cosme *et al.*	(ORSAY)
COSME	74B	PL 48B 159	G. Cosme *et al.*	(ORSAY)
DEGROOT	74	NP B74 77	A.J. de Groot *et al.*	(AMST, NIJM)
AUGUSTIN	73	PRL 30 462	J.E. Augustin *et al.*	(ORSAY)
BALLAM	73	PR D7 3150	J. Ballam *et al.*	(SLAC, LBL)

BINNIE	73B	PR D8 2789	D.M. Binnie *et al.*	(LOIC, SHMP)
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez *et al.*	(BNL)
ALVENSLEB...	72	PRL 28 66	H. Alvensleben *et al.*	(MIT, DESY)
BORENSTEIN	72	PR D5 1559	S.R. Borenstein *et al.*	(BNL, MICH)
COLLEY	72	NP B50 1	D.C. Colley *et al.*	(BIRM, GLAS)
BALAKIN	71	PL 34B 328	V.E. Balakin *et al.*	(NOVO)
CHATELUS	71	Thesis LAL 1247	Y. Chatelus	(STRB)
Also		PL 32B 416	J.C. Bizot *et al.*	(ORSAY)
HAYES	71	PR D4 899	S. Hayes *et al.*	(CORN)
STOTTLE...	71	Thesis ORO 2504 170	A.R. Stottlemyer	(UMD)
BIZOT	70	PL 32B 416	J.C. Bizot *et al.*	(ORSAY)
Also		Liverpool Sym. 69	J.P. Perez-y-Jorba	
EARLES	70	PRL 25 1312	D.R. Earles *et al.*	(NEAS)
LINDSEY	66	PR 147 913	J.S. Lindsey, G. Smith	(LRL)
LONDON	66	PR 143 1034	G.W. London *et al.*	(BNL, SYRA) IGJPC
BADIER	65B	PL 17 337	J. Badier *et al.*	(EPOL, SACL, AMST)
LINDSEY	65	PRL 15 221	J.S. Lindsey, G.A. Smith	(LRL)
LINDSEY 65 data included in LINDSEY 66.				
SCHLEIN	63	PRL 10 368	P.E. Schlein *et al.*	(UCLA) IGJP