$\eta'(958)$ WIDTH

We include direct measurements of the $\eta'(958)$ total width and $\gamma\gamma$ partial width together with the measured branching ratios in the fit for the partial decay rates.

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
0.201±0.016 OUR FIT	Error includes scale factor of 1.3.					
0.28 ±0.10	1000	BINNIE	79	MMS	0	$\pi^- p \rightarrow n$MM

$\eta'(958)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$\pi^+\pi^-\eta$	(43.7 ±1.5) %	S=1.1
Γ_2	$\rho^0\gamma$	(30.2 ±1.3) %	S=1.1
Γ_3	$\pi^0\pi^0\eta$	(20.8 ±1.3) %	S=1.2
Γ_4	$\omega\gamma$	(3.02±0.30) %	
Γ_5	$\gamma\gamma$	(2.12±0.13) %	S=1.2
Γ_6	$3\pi^0$	(1.55±0.26) $\times 10^{-3}$	
Γ_7	$\mu^+\mu^-\gamma$	(1.04±0.26) $\times 10^{-4}$	
Γ_8	$\pi^+\pi^-\pi^0$	< 5 %	CL=90%
Γ_9	$\pi^0\rho^0$	< 4 %	CL=90%
Γ_{10}	$\pi^+\pi^-$	< 2 %	CL=90%
Γ_{11}	$\pi^0 e^+ e^-$	< 1.3 %	CL=90%
Γ_{12}	$\eta e^+ e^-$	< 1.1 %	CL=90%
Γ_{13}	$\pi^+\pi^+\pi^-\pi^-$	< 1 %	CL=90%
Γ_{14}	$\pi^+\pi^+\pi^-\pi^-$ neutrals	< 1 %	CL=95%
Γ_{15}	$\pi^+\pi^+\pi^-\pi^-\pi^0$	< 1 %	CL=90%
Γ_{16}	6π	< 1 %	CL=90%
Γ_{17}	$\pi^+\pi^- e^+ e^-$	< 6 $\times 10^{-3}$	CL=90%
Γ_{18}	$\pi^0\pi^0$	< 9 $\times 10^{-4}$	CL=90%
Γ_{19}	$\pi^0\gamma\gamma$	< 8 $\times 10^{-4}$	CL=90%
Γ_{20}	$4\pi^0$	< 5 $\times 10^{-4}$	CL=90%
Γ_{21}	3γ	< 1.0 $\times 10^{-4}$	CL=90%
Γ_{22}	$\mu^+\mu^-\pi^0$	< 6.0 $\times 10^{-5}$	CL=90%
Γ_{23}	$\mu^+\mu^-\eta$	< 1.5 $\times 10^{-5}$	CL=90%
Γ_{24}	$\pi^+\pi^-\gamma$ (including $\rho^0\gamma$)	(27.9 ±2.3) %	
Γ_{25}	$e^+ e^-$	< 2.1 $\times 10^{-7}$	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, 2 combinations of partial widths obtained from integrated cross section, and 16 branching ratios uses 45 measurements and one constraint to determine 7 parameters. The overall fit has a $\chi^2 = 33.4$ for 39 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle\delta p_i \delta p_j\right\rangle/(\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i, including 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	−49					
x_3	−63	−35				
x_4	−27	−25	34			
x_5	−22	−13	27	8		
x_6	−23	−13	36	12	10	
Γ	35	−11	−21	−3	−83	−7
	x_1	x_2	x_3	x_4	x_5	x_6

	Mode	Rate (MeV)	Scale factor
Γ_1	$\pi^+\pi^-\eta$	0.088 ±0.009	1.2
Γ_2	$\rho^0\gamma$	0.061 ±0.005	1.3
Γ_3	$\pi^0\pi^0\eta$	0.042 ±0.004	1.5
Γ_4	$\omega\gamma$	0.0061 ±0.0008	1.2
Γ_5	$\gamma\gamma$	0.00426±0.00019	1.1
Γ_6	$3\pi^0$	(3.1 ±0.6) $\times 10^{-4}$	1.1

$\eta'(958)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ — Γ_5

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
4.26±0.19 OUR FIT	Error includes scale factor of 1.1.				
4.34±0.25 OUR AVERAGE					
4.53±0.29±0.51	266±17	KARCH	92	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
3.62±0.14±0.48		[1] BEHREND	91	CELL	$e^+e^- \rightarrow e^+e^-\eta'(958)$
4.6 ±1.1 ±0.6	23	BARU	90	MD1	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
4.57±0.25±0.44		BUTLER	90	MRK2	$e^+e^- \rightarrow e^+e^-\eta'(958)$
4.94±0.23±0.72	547	[2] ROE	90	ASP	$e^+e^- \rightarrow e^+e^-2\gamma$
3.8 ±0.7 ±0.6	34	AIHARA	88C	TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.8 ±0.5 ±0.5	136±14	[2] WILLIAMS	88	CBAL	$e^+e^- \rightarrow e^+e^-2\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.7 ±0.6 ±0.9	143±12	[3] GIDAL	87	MRK2	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.0 ±0.9		[4] BARTEL	85E	JADE	$e^+e^- \rightarrow e^+e^-2\gamma$

[1] Using B($\eta' \rightarrow \rho(770)\gamma$) = (30.1 ± 1.4)%.
[2] Using B($\eta' \rightarrow \gamma\gamma$) = (2.17 ± 0.17)%.
[3] Superseded by BUTLER 90.
[4] Systematic error not evaluated.

$\eta'(958)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

This combination of a partial width with the partial width into $\gamma\gamma$ and with the total width is obtained from the integrated cross section into channel(i) in the $\gamma\gamma$ annihilation.

$\Gamma(\gamma\gamma) \times \Gamma(\rho^0\gamma)/\Gamma_{\rm total}$ — $\Gamma_5\Gamma_2/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
1.29±0.06 OUR FIT	Error includes scale factor of 1.2.				
1.26±0.07 OUR AVERAGE	Error includes scale factor of 1.2.				
1.09±0.04±0.13		BEHREND	91	CELL	$e^+e^- \rightarrow e^+e^-\rho(770)^0\gamma$
1.35±0.09±0.21		AIHARA	87	TPC	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.13±0.04±0.13	867±30	ALBRECHT	87B	ARG	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.53±0.09±0.21		ALTHOFF	84E	TASS	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.14±0.08±0.11	243±16.5	BERGER	84B	PLUT	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.73±0.34±0.35	95	JENNI	83	MRK2	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.49±0.13±0.027	213	BARTEL	82B	JADE	$e^+e^- \rightarrow e^+e^-\rho\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.85±0.31±0.24	43	BEHREND	83B	CELL	$e^+e^- \rightarrow e^+e^-\rho\gamma$

$\Gamma(\gamma\gamma) \times \Gamma(\pi^0\pi^0\eta)/\Gamma_{\rm total}$ — $\Gamma_5\Gamma_3/\Gamma$

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
0.88±0.07 OUR FIT	Error includes scale factor of 1.1.			
0.93±0.06±0.11	[5] KARCH	92	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.95±0.05±0.08	[6] KARCH	90	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
1.00±0.08±0.10	[5,6] ANTREASYAN	87	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$

[5] Using BR($\eta \rightarrow 2\gamma$)=(38.9 ± 0.5)%.
[6] Superseded by KARCH 92.

$\eta'(958)$ α PARAMETER

$\left|\text{MATRIX ELEMENT}\right|^2 = (1 + \alpha y)^2 + cx^2$

VALUE	DOCUMENT ID		TECN	COMMENT
−0.058±0.013	[7] ALDE	86	GAM2	38 $\pi^- p \rightarrow n\eta 2\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.08 ±0.03	[7] KALBFLEISCH	74	RVUE	$\eta' \rightarrow \eta\pi^+\pi^-$

[7] May not necessarily be the same for $\eta' \rightarrow \eta\pi^+\pi^-$ and $\eta' \rightarrow \eta\pi^0\pi^0$.

$\eta'(958)$ BRANCHING RATIOS

$\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))/\Gamma_{\rm total}$ — $0.709\Gamma_1/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.310±0.011 OUR FIT	Error includes scale factor of 1.1.				
0.314±0.026	281	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

$\Gamma(\pi^+\pi^-\text{neutrals})/\Gamma_{\rm total}$ — $(0.709\Gamma_1+0.291\Gamma_3+0.9\Gamma_4)/\Gamma$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.398±0.009 OUR FIT	Error includes scale factor of 1.1.				
0.36 ±0.05 OUR AVERAGE					
0.4 ±0.1	39	LONDON	66	HBC	2.24 $K^- p \rightarrow \Lambda\pi^+\pi^-$ neutrals
0.35 ±0.06	33	BADIER	65B	HBC	3 $K^- p$