η

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

We have omitted some results that have been superseded by later experiments. The omitted results may be found in our 1988 edition Physics Letters **B204** (1988).

η MASS

We no longer use the bubble-chamber measurements from the 1960's, which seem to have been systematically high by about 1 MeV. Some early results have been omitted altogether.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
547.30±0.12 OUR AVERAGE					
547.12±0.06±0.25		KRUSCHE	95D	SPEC	$\gamma p \to \eta p$, threshold
547.30±0.15		PLOUIN	92	SPEC	$d p \to \eta\, ^3\mathrm{He}$
547.45±0.25		DUANE	74	SPEC	$\pi^- p \to n$ neutrals
• • • We do not use the following data for averages, fits, limits, etc. • • •					
548.2 ±0.65		FOSTER	65C	HBC	
549.0 ±0.7	148	FOELSCHE	64	HBC	
548.0 ±1.0	91	ALFF-...	62	HBC	
549.0 ±1.2	53	BASTIEN	62	HBC	

η WIDTH

This is the partial decay rate $\Gamma(\eta \to \gamma\gamma)$ divided by the fitted branching fraction for that mode. See the "Note on the Decay Width $\Gamma(\eta \to \gamma\gamma)$" in our 1994 edition, Phys. Rev. **D50**, 1 August 1994, Part I, p. 1451.

VALUE (keV)	*DOCUMENT ID*
1.18±0.11 OUR FIT	Error includes scale factor of 1.8.

η DECAY MODES

	Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Neutral modes			
Γ_1	neutral modes		(71.6 ±0.4) %	S=1.2
Γ_2	2γ	[a]	(39.33±0.25) %	S=1.1
Γ_3	$3\pi^0$		(32.24±0.29) %	S=1.2
Γ_4	$\pi^0 2\gamma$		(7.1 ±1.4) $\times 10^{-4}$	
Γ_5	other neutral modes		< 2.8 %	CL=90%

Charged modes

Γ_6	charged modes			(28.3 ± 0.4) %	S=1.2
Γ_7	$\pi^+\pi^-\pi^0$			(23.0 ± 0.4) %	S=1.2
Γ_8	$\pi^+\pi^-\gamma$			(4.75 ± 0.11) %	S=1.1
Γ_9	$e^+e^-\gamma$			$(4.9 \pm 1.1) \times 10^{-3}$	
Γ_{10}	$\mu^+\mu^-\gamma$			$(3.1 \pm 0.4) \times 10^{-4}$	
Γ_{11}	e^+e^-			$< 7.7 \times 10^{-5}$	CL=90%
Γ_{12}	$\mu^+\mu^-$			$(5.8 \pm 0.8) \times 10^{-6}$	
Γ_{13}	$\pi^+\pi^-e^+e^-$			$(1.3 {}^{+1.2}_{-0.8}) \times 10^{-3}$	
Γ_{14}	$\pi^+\pi^-2\gamma$			$< 2.1 \times 10^{-3}$	
Γ_{15}	$\pi^+\pi^-\pi^0\gamma$			$< 6 \times 10^{-4}$	CL=90%
Γ_{16}	$\pi^0\mu^+\mu^-\gamma$			$< 3 \times 10^{-6}$	CL=90%

Charge conjugation (C), Parity (P), Charge conjugation × Parity (CP), or Lepton Family number (LF) violating modes

Γ_{17}	$\pi^+\pi^-$	P,CP		$< 3.3 \times 10^{-4}$	CL=90%
Γ_{18}	$\pi^0\pi^0$	P,CP		$< 4.3 \times 10^{-4}$	CL=90%
Γ_{19}	3γ	C		$< 5 \times 10^{-4}$	CL=95%
Γ_{20}	$\pi^0e^+e^-$	C	[b]	$< 4 \times 10^{-5}$	CL=90%
Γ_{21}	$\pi^0\mu^+\mu^-$	C	[b]	$< 5 \times 10^{-6}$	CL=90%
Γ_{22}	$\mu^+e^- + \mu^-e^+$	LF		$< 6 \times 10^{-6}$	CL=90%

[a] See the "Note on the Decay Width $\Gamma(\eta \rightarrow \gamma\gamma)$" in our 1994 edition, Phys. Rev. **D50**, 1 August 1994, Part I, p. 1451.

[b] C parity forbids this to occur as a single-photon process.

CONSTRAINED FIT INFORMATION

An overall fit to a decay rate and 16 branching ratios uses 42 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 32.8$ for 34 degrees of freedom.

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

x_3	39							
x_4	1	1						
x_7	−74	−79	−4					
x_8	−58	−62	−3	64				
x_9	−12	−13	−1	−9	−8			
x_{10}	0	0	0	−1	0	0		
x_{13}	−9	−10	0	−16	−11	−2	0	
Γ	−7	−3	0	5	4	1	0	1
	x_2	x_3	x_4	x_7	x_8	x_9	x_{10}	x_{13}

	Mode		Rate (keV)	Scale factor
Γ_2	2γ	[a]	0.46 ± 0.04	1.8
Γ_3	$3\pi^0$		0.381 ± 0.035	1.8
Γ_4	$\pi^0 2\gamma$		$(8.4 \pm 1.9) \times 10^{-4}$	1.1
Γ_7	$\pi^+\pi^-\pi^0$		0.271 ± 0.025	1.8
Γ_8	$\pi^+\pi^-\gamma$		0.056 ± 0.005	1.7
Γ_9	$e^+e^-\gamma$		0.0058 ± 0.0014	
Γ_{10}	$\mu^+\mu^-\gamma$		$(3.7 \pm 0.6) \times 10^{-4}$	1.1
Γ_{13}	$\pi^+\pi^-e^+e^-$		$0.0016^{+0.0014}_{-0.0010}$	

η DECAY RATES

$\Gamma(2\gamma)$ Γ_2

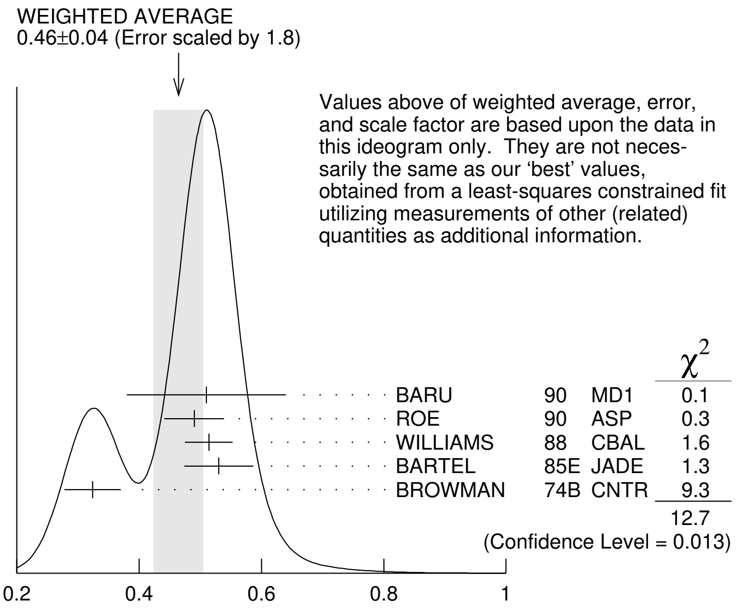
See the table immediately above giving the fitted decay rates. See also the "Note on the Decay Width $\Gamma(\eta \to \gamma\gamma)$," in our 1994 edition, Phys. Rev. **D50**, 1 August 1994, Part I, p. 1451.

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.46 ±0.04 OUR FIT	Error includes scale factor of 1.8.				
0.46 ±0.04 OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below.				
0.51 ±0.12 ±0.05	36	BARU	90	MD1	$e^+e^- \to e^+e^-\eta$
0.490±0.010±0.048	2287	ROE	90	ASP	$e^+e^- \to e^+e^-\eta$
0.514±0.017±0.035	1295	WILLIAMS	88	CBAL	$e^+e^- \to e^+e^-\eta$
0.53 ±0.04 ±0.04		BARTEL	85E	JADE	$e^+e^- \to e^+e^-\eta$
0.324±0.046		BROWMAN	74B	CNTR	Primakoff effect

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

0.64 ±0.14 ±0.13		AIHARA	86	TPC	$e^+e^- \rightarrow e^+e^-\eta$
0.56 ±0.16	56	WEINSTEIN	83	CBAL	$e^+e^- \rightarrow e^+e^-\eta$
1.00 ±0.22		[1] BEMPORAD	67	CNTR	Primakoff effect

[1] BEMPORAD 67 gives $\Gamma(2\gamma)$ = 1.21 ± 0.26 keV assuming $\Gamma(2\gamma)/\Gamma(\text{total})$ = 0.314. Bemporad private communication gives $\Gamma(2\gamma)^2/\Gamma(\text{total})$ = 0.380 ± 0.083. We evaluate this using $\Gamma(2\gamma)/\Gamma(\text{total}) = 0.38 \pm 0.01$. Not included in average because the uncertainty resulting from the separation of the coulomb and nuclear amplitudes has apparently been underestimated.



$\Gamma(2\gamma)$ (keV)

η BRANCHING RATIOS

Neutral modes

$\Gamma(\text{neutral modes})/\Gamma_{\text{total}}$ $\qquad\Gamma_1/\Gamma = (\Gamma_2+\Gamma_3+\Gamma_4)/\Gamma$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.716±0.004 OUR FIT	Error includes scale factor of 1.2.				
0.705±0.008	16k	BASILE	71D	CNTR	MM spectrometer
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.79 ±0.08		BUNIATOV	67	OSPK	

$\Gamma(2\gamma)/\Gamma_{\text{total}}$ $\qquad\Gamma_2/\Gamma$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.3933±0.0025 OUR FIT	Error includes scale factor of 1.1.				
0.3949±0.0017±0.0030	65k	ABEGG	96	SPEC	$p d \rightarrow {}^3\text{He}\eta$

$\Gamma(2\gamma)/\Gamma(\text{neutral modes})$ — $\Gamma_2/\Gamma_1 = \Gamma_2/(\Gamma_2+\Gamma_3+\Gamma_4)$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.5490±0.0021 OUR FIT Error includes scale factor of 1.1.					
0.549 ±0.004 OUR AVERAGE					
0.549 ±0.004		ALDE	84	GAM2	
0.535 ±0.018		BUTTRAM	70	OSPK	
0.59 ±0.033		BUNIATOV	67	OSPK	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.52 ±0.09	88	ABROSIMOV	80	HLBC	
0.60 ±0.14	113	KENDALL	74	OSPK	
0.57 ±0.09		STRUGALSKI	71	HLBC	
0.579 ±0.052		FELDMAN	67	OSPK	
0.416 ±0.044		DIGIUGNO	66	CNTR	Error doubled
0.44 ±0.07		GRUNHAUS	66	OSPK	
0.39 ±0.06		[2] JONES	66	CNTR	

[2] This result from combining cross sections from two different experiments.

$\Gamma(3\pi^0)/\Gamma(\text{neutral modes})$ — $\Gamma_3/\Gamma_1 = \Gamma_3/(\Gamma_2+\Gamma_3+\Gamma_4)$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.4500±0.0021 OUR FIT Error includes scale factor of 1.1.					
0.450 ±0.004 OUR AVERAGE					
0.450 ±0.004		ALDE	84	GAM2	
0.439 ±0.024		BUTTRAM	70	OSPK	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.44 ±0.08	75	ABROSIMOV	80	HLBC	
0.32 ±0.09		STRUGALSKI	71	HLBC	
0.41 ±0.033		BUNIATOV	67	OSPK	Not indep. of $\Gamma(2\gamma)/\Gamma(\text{neutral modes})$
0.177 ±0.035		FELDMAN	67	OSPK	
0.209 ±0.054		DIGIUGNO	66	CNTR	Error doubled
0.29 ±0.10		GRUNHAUS	66	OSPK	

$\Gamma(3\pi^0)/\Gamma(2\gamma)$ — Γ_3/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
0.820±0.007 OUR FIT Error includes scale factor of 1.1.				
0.825±0.011 OUR AVERAGE				
0.796±0.016±0.016	ACHASOV	00	SND	$e^+e^- \to \phi \to \eta\gamma$
0.832±0.005±0.012	KRUSCHE	95D	SPEC	$\gamma p \to \eta p$, threshold
0.841±0.034	AMSLER	93	CBAR	$\overline{p}p \to \pi^+\pi^-\eta$ at rest
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.822±0.009	[3] ALDE	84	GAM2	
0.91 ±0.14	COX	70B	HBC	
0.75 ±0.09	DEVONS	70	OSPK	
0.88 ±0.16	BALTAY	67D	DBC	
1.1 ±0.2	CENCE	67	OSPK	
1.25 ±0.39	BACCI	63	CNTR	Inverse BR reported

[3] This result is not independent of other ALDE 84 results in this Listing, and so is omitted from the fit and average.

$\Gamma(\pi^0 2\gamma)/\Gamma(\text{neutral modes})$ — $\Gamma_4/\Gamma_1 = \Gamma_4/(\Gamma_2+\Gamma_3+\Gamma_4)$

VALUE	DOCUMENT ID		TECN
(1.00 ±0.20) × 10^{-3} OUR FIT			
0.0010 ±0.0002	ALDE	84	GAM2

$\Gamma(\pi^0 2\gamma)/\Gamma_{\text{total}}$ — Γ_4/Γ

These results are summarized in the review by LANDSBERG 85.

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
7.1±1.4 OUR FIT						
• • • We do not use the following data for averages, fits, limits, etc. • • •						
9.5±2.3		70	BINON	82	GAM2	See ALDE 84
<30	90	0	DAVYDOV	81	GAM2	$\pi^- p \rightarrow \eta n$

$\Gamma(\text{neutral modes})/\left[\Gamma(\pi^+\pi^-\pi^0) + \Gamma(\pi^+\pi^-\gamma) + \Gamma(e^+e^-\gamma)\right]$ — $\Gamma_1/(\Gamma_7+\Gamma_8+\Gamma_9) = (\Gamma_2+\Gamma_3+\Gamma_4)/(\Gamma_7+\Gamma_8+\Gamma_9)$

VALUE	EVTS	DOCUMENT ID		TECN
2.54±0.06 OUR FIT Error includes scale factor of 1.3.				
2.64±0.23		BALTAY	67B	DBC
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.5 ±1.0	280	[4] JAMES	66	HBC
3.20±1.26	53	[4] BASTIEN	62	HBC
2.5 ±1.0	10	[4] PICKUP	62	HBC

[4] These experiments are not used in the averages as they do not separate clearly $\eta \rightarrow \pi^+\pi^-\pi^0$ and $\eta \rightarrow \pi^+\pi^-\gamma$ from each other. The reported values thus probably contain some unknown fraction of $\eta \rightarrow \pi^+\pi^-\gamma$.

$\Gamma(2\gamma)/\left[\Gamma(\pi^+\pi^-\pi^0) + \Gamma(\pi^+\pi^-\gamma) + \Gamma(e^+e^-\gamma)\right]$ — $\Gamma_2/(\Gamma_7+\Gamma_8+\Gamma_9)$

VALUE	EVTS	DOCUMENT ID		TECN
1.395±0.030 OUR FIT Error includes scale factor of 1.2.				
1.1 ±0.4 OUR AVERAGE				
1.51 ±0.93	75	KENDALL	74	OSPK
0.99 ±0.48		CRAWFORD	63	HBC

$\Gamma(\text{neutral modes})/\Gamma(\pi^+\pi^-\pi^0)$ — $\Gamma_1/\Gamma_7 = (\Gamma_2+\Gamma_3+\Gamma_4)/\Gamma_7$

VALUE	EVTS	DOCUMENT ID		TECN
3.12±0.07 OUR FIT Error includes scale factor of 1.3.				
3.26±0.30 OUR AVERAGE				
2.54±1.89	74	KENDALL	74	OSPK
3.4 ±1.1	29	AGUILAR-...	72B	HBC
2.83±0.80	70	[5] BLOODWO...	72B	HBC
3.6 ±0.6	244	FLATTE	67B	HBC
2.89±0.56		ALFF-...	66	HBC
3.6 ±0.8	50	KRAEMER	64	DBC
3.8 ±1.1		PAULI	64	DBC

[5] Error increased from published value 0.5 by Bloodworth (private communication).

$\Gamma(2\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_2/Γ_7

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.71±0.04 OUR FIT Error includes scale factor of 1.2.					
1.75±0.13 OUR AVERAGE					
1.78±0.10±0.13	1077	AMSLER	95	CBAR	$\overline{p}p \to \pi^+\pi^-\eta$ at rest
1.72±0.25	401	BAGLIN	69	HLBC	
1.61±0.39		FOSTER	65	HBC	

$\Gamma(3\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_3/Γ_7

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.404±0.034 OUR FIT Error includes scale factor of 1.3.					
1.34 ±0.10 OUR AVERAGE Error includes scale factor of 1.2.					
1.44 ±0.09 ±0.10	1627	AMSLER	95	CBAR	$\overline{p}p \to \pi^+\pi^-\eta$ at rest
$1.50\ ^{+0.15}_{-0.29}$	199	BAGLIN	69	HLBC	
$1.47\ ^{+0.20}_{-0.17}$		BULLOCK	68	HLBC	
1.3 ±0.4		BAGLIN	67B	HLBC	
0.90 ±0.24		FOSTER	65	HBC	
2.0 ±1.0		FOELSCHE	64	HBC	
0.83 ±0.32		CRAWFORD	63	HBC	

$\Gamma(\text{other neutral modes})/\Gamma_{\text{total}}$ — Γ_5/Γ

These are neutral modes other than $\gamma\gamma$, $3\pi^0$, and $\pi^0\gamma\gamma$; nearly any such mode one can think of would violate *P*, or *C*, or both.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.028	90	ABEGG	96	SPEC	$pd \to {}^3\text{He}\eta$

Charged modes

$\Gamma(\pi^+\pi^-\pi^0)/[\Gamma(2\gamma)+\Gamma(3\pi^0)]$ — $\Gamma_7/(\Gamma_2+\Gamma_3)$

VALUE	DOCUMENT ID		TECN	COMMENT
0.321 ±0.007 OUR FIT Error includes scale factor of 1.2.				
0.3141±0.0081±0.0058	ACHASOV	00B	SND	$e^+e^- \to \phi \to \eta\gamma$

$\Gamma(\pi^+\pi^-\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_8/Γ_7

VALUE	EVTS	DOCUMENT ID		TECN
0.207±0.004 OUR FIT Error includes scale factor of 1.1.				
0.207±0.004 OUR AVERAGE Error includes scale factor of 1.1.				
0.209±0.004	18k	THALER	73	ASPK
0.201±0.006	7250	GORMLEY	70	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.28 ±0.04		BALTAY	67B	DBC
0.25 ±0.035		LITCHFIELD	67	DBC
0.30 ±0.06		CRAWFORD	66	HBC
0.196±0.041		FOSTER	65C	HBC

$\Gamma(e^+e^-\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_9/Γ_7

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.1±0.5 OUR FIT					
2.1±0.5	80	JANE	75B	OSPK	See the erratum

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
3.1±0.4 OUR FIT					
3.1±0.4	600	DZHELYADIN	80	SPEC	$\pi^- p \to \eta n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.5±0.75	100	BUSHNIN	78	SPEC	See DZHELYADIN 80

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<0.77	90	BROWDER	97B	CLE2	$e^+e^- \simeq$ 10.5 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2	90	WHITE	96	SPEC	$p d \to \eta {}^3$He
<3	90	DAVIES	74	RVUE	Uses ESTEN 67

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

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
5.8±0.8 OUR AVERAGE						
5.7±0.7±0.5		114	ABEGG	94	SPEC	$p d \to \eta {}^3$He
6.5±2.1		27	DZHELYADIN	80B	SPEC	$\pi^- p \to \eta n$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$5.6^{+0.6}_{-0.7}\pm0.5$		100	KESSLER	93	SPEC	See ABEGG 94
<20	95	0	WEHMANN	68	OSPK	

$\Gamma(\mu^+\mu^-)/\Gamma(2\gamma)$ — Γ_{12}/Γ_2

VALUE (units 10^{-5})	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5.9±2.2	HYAMS	69	OSPK

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-\gamma)$ — Γ_{13}/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN
$0.028^{+0.026}_{-0.017}$ OUR FIT				
0.026±0.026	1	GROSSMAN	66	HBC

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma_{total}$ — Γ_{13}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN
$0.13^{+0.12}_{-0.08}$ OUR FIT			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.7	RITTENBERG	65	HBC

$\Gamma(\pi^+\pi^-2\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_{14}/Γ_7

VALUE	CL%	DOCUMENT ID		TECN
<0.009		PRICE	67	HBC
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.016	95	BALTAY	67B	DBC

$\Gamma(\pi^+\pi^-\pi^0\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_{15}/Γ_7

VALUE (units 10^{-2})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*
<0.24	90	0	THALER	73	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.7	90		ARNOLD	68	HLBC
<1.6	95		BALTAY	67B	DBC
<7.0			FLATTE	67	HBC
<0.9			PRICE	67	HBC

$\Gamma(\pi^0\mu^+\mu^-\gamma)/\Gamma_{total}$ — Γ_{16}/Γ

VALUE (units 10^{-6})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<3	90	DZHELYADIN	81	SPEC	$\pi^- p \to \eta n$

Rare or forbidden modes

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ — Γ_{17}/Γ

Forbidden by *P* and *CP* invariance.

VALUE (units 10^{-4})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
< 3.3 (CL = 90%)						
< 3.3	90		AKHMETSHIN	99B	CMD2	$e^+e^- \to \phi \to \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 9	90		AKHMETSHIN	97C	CMD2	See AKHMETSHIN 99B
<15		0	THALER	73	ASPK	

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

Forbidden by *P* and *CP* invariance.

VALUE (units 10^{-4})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<4.3	90	AKHMETSHIN	99C	CMD2	$e^+e^- \to \phi \to \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6	90	[6] ACHASOV	98	SND	$e^+e^- \to \phi \to \eta\gamma$

[6] ACHASOV 98 observes one event in a $\pm3\sigma$ region around the η mass, while a Monte Carlo calculation gives 10 ± 5 events. The limit here is the Poisson upper limit for one observed event and no background.

$\Gamma(3\gamma)/\Gamma(\text{neutral modes})$ — $\Gamma_{19}/\Gamma_1 = \Gamma_{19}/(\Gamma_2+\Gamma_3+\Gamma_4)$

Forbidden by *C* invariance.

VALUE (units 10^{-4})	*CL%*	*DOCUMENT ID*		*TECN*
<7	95	ALDE	84	GAM2

$\Gamma(\pi^0 e^+e^-)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_{20}/Γ_7

C parity forbids this to occur as a single-photon process.

VALUE (units 10^{-4})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*
< 1.9	90		JANE	75	OSPK
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 42	90		BAGLIN	67	HLBC
< 16	90	0	BILLING	67	HLBC
< 77		0	FOSTER	65B	HBC
<110			PRICE	65	HBC

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

C parity forbids this to occur as a single-photon process.

VALUE (units 10^{-2})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.016	90	0	MARTYNOV	76	HLBC
<0.084	90		BAZIN	68	DBC
<0.7			RITTENBERG	65	HBC

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

C parity forbids this to occur as a single-photon process.

VALUE (units 10^{-4})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.05	90	DZHELYADIN	81	SPEC	$\pi^- p \to \eta n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<5		WEHMANN	68	OSPK	

$[\Gamma(\mu^+ e^-) + \Gamma(\mu^- e^+)]/\Gamma_{total}$ Γ_{22}/Γ

Forbidden by lepton family number conservation.

VALUE (units 10^{-6})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<6	90	WHITE	96	SPEC	$p d \to \eta\, ^3\mathrm{He}$

η *C*-NONCONSERVING DECAY PARAMETERS

$\pi^+ \pi^- \pi^0$ LEFT-RIGHT ASYMMETRY PARAMETER

Measurements with an error $> 1.0 \times 10^{-2}$ have been omitted.

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*
0.09±0.17 OUR AVERAGE				
0.28±0.26	165k	JANE	74	OSPK
−0.05±0.22	220k	LAYTER	72	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.5 ±0.5	37k	[7] GORMLEY	68C	ASPK

[7] The GORMLEY 68C asymmetry is probably due to unmeasured ($\mathbf{E} \times \mathbf{B}$) spark chamber effects. New experiments with ($\mathbf{E} \times \mathbf{B}$) controls don't observe an asymmetry.

$\pi^+ \pi^- \pi^0$ SEXTANT ASYMMETRY PARAMETER

Measurements with an error $> 2.0 \times 10^{-2}$ have been omitted.

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*
0.18±0.16 OUR AVERAGE				
0.20±0.25	165k	JANE	74	OSPK
0.10±0.22	220k	LAYTER	72	ASPK
0.5 ±0.5	37k	GORMLEY	68C	WIRE

$\pi^+ \pi^- \pi^0$ QUADRANT ASYMMETRY PARAMETER

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*
−0.17±0.17 OUR AVERAGE				
−0.30±0.25	165k	JANE	74	OSPK
−0.07±0.22	220k	LAYTER	72	ASPK

$\pi^+\pi^-\gamma$ LEFT-RIGHT ASYMMETRY PARAMETER

Measurements with an error $> 2.0 \times 10^{-2}$ have been omitted.

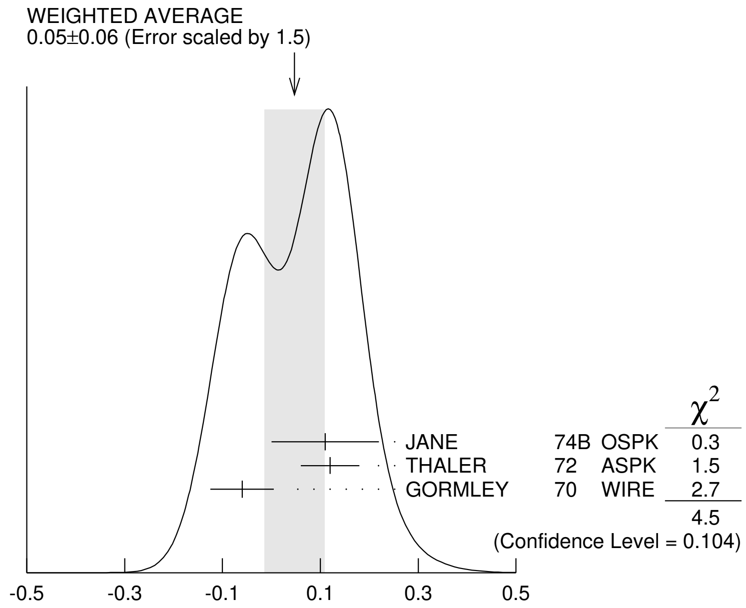
VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*
0.9 ±0.4 OUR AVERAGE				
1.2 ±0.6	35k	JANE	74B	OSPK
0.5 ±0.6	36k	THALER	72	ASPK
1.22±1.56	7257	GORMLEY	70	ASPK

$\pi^+\pi^-\gamma$ PARAMETER β (*D*-wave)

Sensitive to a *D*-wave contribution: $dN/d\cos\theta = \sin^2\theta\ (1 + \beta\ \cos^2\theta)$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*
0.05 ±0.06 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
0.11 ±0.11	35k	JANE	74B	OSPK
0.12 ±0.06		[8] THALER	72	ASPK
−0.060±0.065	7250	GORMLEY	70	WIRE

[8] The authors don't believe this indicates *D*-wave because the dependence of β on the γ energy is inconsistent with theoretical prediction. A $\cos^2\theta$ dependence may also come from *P*- and *F*-wave interference.



$\eta \to \pi^+\pi^-\gamma$ parameter β (*D*-wave)

ENERGY DEPENDENCE OF $\eta \rightarrow 3\pi$ DALITZ PLOTS

PARAMETERS FOR $\eta \rightarrow \pi^+\pi^-\pi^0$

See the "Note on η Decay Parameters" in our 1994 edition, Phys. Rev. **D50**, 1 August 1994, Part I, p. 1454. The following experiments fit to one or more of the coefficients a, b, c, d, or e for $|\text{matrix element}|^2 = 1 + ay + by^2 + cx + dx^2 + exy$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
	3230	[9] ABELE	98D	CBAR	$\overline{p}p \rightarrow \pi^0\pi^0\eta$ at rest
	1077	[10] AMSLER	95	CBAR	$\overline{p}p \rightarrow \pi^+\pi^-\eta$ at rest
	81k	LAYTER	73	ASPK	
	220k	LAYTER	72	ASPK	
	1138	CARPENTER	70	HBC	
	349	DANBURG	70	DBC	
	7250	GORMLEY	70	WIRE	
	526	BAGLIN	69	HLBC	
	7170	CNOPS	68	OSPK	
	37k	GORMLEY	68C	WIRE	
	1300	CLPWY	66	HBC	
	705	LARRIBE	66	HBC	

[9] ABELE 98D obtain $a = -1.22 \pm 0.07$ and $b = 0.22 \pm 0.11$ when c (our d) is fixed at 0.06.

[10] AMSLER 95 fits to $(1+ay+by^2)$ and obtains $a=-0.94 \pm 0.15$ and $b=0.11 \pm 0.27$.

α PARAMETER FOR $\eta \rightarrow 3\pi^0$

See the "Note on η Decay Parameters" in our 1994 edition, Phys. Rev. **D50**, 1 August 1994, Part I, p. 1454. The value here is of α in $|\text{matrix element}|^2 = 1 + 2\alpha z$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$-$0.039±0.015 OUR AVERAGE					
$-$0.052±0.017±0.010	98k	ABELE	98C	CBAR	$\overline{p}p \rightarrow 5\pi^0$
$-$0.022±0.023	50k	ALDE	84	GAM2	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$-$0.32 ±0.37	192	BAGLIN	70	HLBC	

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