$a_0(980)$

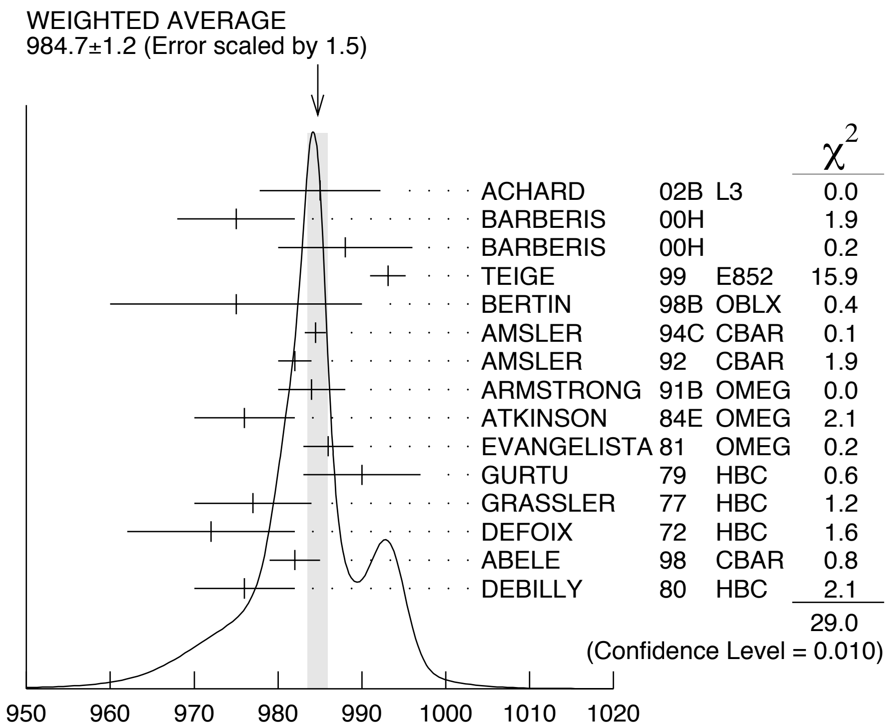
$I^G(J^{PC}) = 1^-(0^{++})$

See our minireview on scalar mesons under $f_0(600)$. (See the index for the page number.)

$a_0(980)$ MASS

VALUE (MeV) — *DOCUMENT ID*

984.7±1.2 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.5. See the ideogram below.



$a_0(980)$ MASS

$\eta\pi$ FINAL STATE ONLY

The data in this block is included in the average printed for a previous datablock.

985.1 ± 1.3 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*	*TECN*	*CHG*	*COMMENT*
985 ± 4 ±6	318	ACHARD 02B	L3		183–209 $e^+e^- \to e^+e^-\eta\pi^+\pi^-$
975 ± 7		BARBERIS 00H			450 $pp \to p_f\eta\pi^0 p_s$
988 ± 8		BARBERIS 00H			450 $pp \to \Delta_f^{++}\eta\pi^- p_s$
993.1 ± 2.1		[1] TEIGE 99	E852		18.3 $\pi^- p \to \eta\pi^+\pi^- n$

975	± 15		BERTIN	98B	OBLX		0.0 $\overline{p}p \to K^{\pm} K_S \pi^{\mp}$
984.45	$\pm$ 1.23 $\pm$ 0.34		AMSLER	94C	CBAR		0.0 $\overline{p}p \to \omega \eta \pi^0$
982	$\pm$ 2		[2] AMSLER	92	CBAR		0.0 $\overline{p}p \to \eta \eta \pi^0$
984	$\pm$ 4	1040	[2] ARMSTRONG	91B	OMEG	$\pm$	300 $pp \to pp\eta\pi^+\pi^-$
976	$\pm$ 6		ATKINSON	84E	OMEG	$\pm$	25–55 $\gamma p \to \eta \pi n$
986	$\pm$ 3	500	[3] EVANGELISTA	81	OMEG	$\pm$	12 $\pi^- p \to \eta \pi^+ \pi^- \pi^- p$
990	$\pm$ 7	145	[3] GURTU	79	HBC	$\pm$	4.2 $K^- p \to \Lambda \eta 2\pi$
977	$\pm$ 7		GRASSLER	77	HBC	$-$	16 $\pi^{\mp} p \to p \eta 3\pi$
972	± 10	150	DEFOIX	72	HBC	$\pm$	0.7 $\overline{p}p \to 7\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •							
995	$^{+52}_{-10}$	36	[4] ACHASOV	00F	SND		$e^+ e^- \to \eta \pi^0 \gamma$
994	$^{+33}_{-\ 8}$	36	[5] ACHASOV	00F	SND		$e^+ e^- \to \eta \pi^0 \gamma$
$\sim$ 1055			[6] OLLER	99	RVUE		$\eta \pi$, $K\overline{K}$
$\sim$ 1009.2			[6] OLLER	99B	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$
988	$\pm$ 6		[6] ANISOVICH	98B	RVUE		Compilation
987			TORNQVIST	96	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
991			JANSSEN	95	RVUE		$\eta\pi \to \eta\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
980	± 11	47	CONFORTO	78	OSPK	$-$	4.5 $\pi^- p \to p X^-$
978	± 16	50	CORDEN	78	OMEG	$\pm$	12–15 $\pi^- p \to n \eta 2\pi$
989	$\pm$ 4	70	WELLS	75	HBC	$-$	3.1–6 $K^- p \to \Lambda \eta 2\pi$
970	± 15	20	BARNES	69C	HBC	$-$	4–5 $K^- p \to \Lambda \eta 2\pi$
980	± 10		CAMPBELL	69	DBC	$\pm$	2.7 $\pi^+ d$
980	± 10	15	MILLER	69B	HBC	$-$	4.5 $K^- N \to \eta \pi \Lambda$
980	± 10	30	AMMAR	68	HBC	$\pm$	5.5 $K^- p \to \Lambda \eta 2\pi$

[1] Breit-Wigner fit, average between $a_0^{\pm}$ and a_0^0. The fit favors a slightly heavier $a_0^{\pm}$.

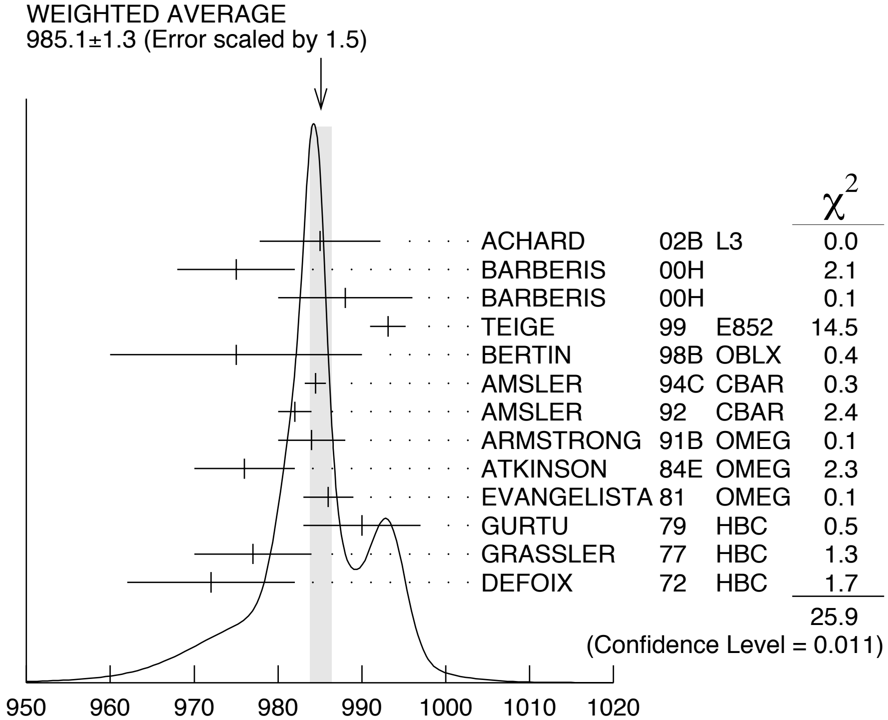
[2] From a single Breit-Wigner fit.

[3] From $f_1(1285)$ decay.

[4] Supersedes ACHASOV 98B. Using the model of ACHASOV 89.

[5] Supersedes ACHASOV 98B. Using the model of JAFFE 77.

[6] T-matrix pole.



$\eta\pi$ FINAL STATE ONLY

$K\overline{K}$ ONLY

VALUE (MeV)	*EVTS*	*DOCUMENT ID*	*TECN*	*CHG*	*COMMENT*
The data in this block is included in the average printed for a previous datablock.					
980.8± 2.7 OUR AVERAGE					
982 ± 3		ABELE [7] 98	CBAR		0.0 $\overline{p}p \to K^0_L K^\pm \pi^\mp$
976 ± 6	316	DEBILLY 80	HBC	±	1.2–2 $\overline{p}p \to f_1(1285)\omega$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1053		OLLER [8] 99C	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$
1016 ±10	100	ASTIER [9] 67	HBC	±	0.0 $\overline{p}p$
1003.3± 7.0	143	ROSENFELD [10] 65	RVUE	±	

[7] T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.
[8] T-matrix pole.
[9] ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.
[10] Plus systematic errors.

a_0(980) WIDTH

VALUE (MeV)	*EVTS*	*DOCUMENT ID*	*TECN*	*CHG*	*COMMENT*

50 to 100 OUR ESTIMATE Width determination very model dependent. Peak width in $\eta\pi$ is about 60 MeV, but decay width can be much larger.

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

50 ±13 ±4	318	ACHARD	02B	L3		183–209 $e^+e^- \to e^+e^-\eta\pi^+\pi^-$
72 ±16		BARBERIS	00H			450 $pp \to p_f\eta\pi^0 p_s$
61 ±19		BARBERIS	00H			450 $pp \to \Delta_f^{++}\eta\pi^- p_s$
~ 42		[11] OLLER	99	RVUE		$\eta\pi$, $K\overline{K}$
~ 112		[11] OLLER	99B	RVUE		$\pi\pi \to \eta\pi$, $K\overline{K}$
71 ± 7		TEIGE	99	E852		18.3 $\pi^- p \to \eta\pi^+\pi^- n$
92 ±20		[11] ANISOVICH	98B	RVUE		Compilation
65 ±10		BERTIN	98B	OBLX		0.0 $\overline{p}p \to K^\pm K_S\pi^\mp$
~ 100		TORNQVIST	96	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
202		JANSSEN	95	RVUE		$\eta\pi \to \eta\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
54.12± 0.34±0.12		AMSLER	94C	CBAR		0.0 $\overline{p}p \to \omega\eta\pi^0$
54 ±10		[12] AMSLER	92	CBAR		0.0 $\overline{p}p \to \eta\eta\pi^0$
95 ±14	1040	[12] ARMSTRONG	91B	OMEG	±	300 $pp \to pp\eta\pi^+\pi^-$
62 ±15	500	[13] EVANGELISTA	81	OMEG	±	12 $\pi^- p \to \eta\pi^+\pi^-\pi^- p$
60 ±20	145	[13] GURTU	79	HBC	±	4.2 $K^- p \to \Lambda\eta 2\pi$
60 $^{+50}_{-30}$	47	CONFORTO	78	OSPK	−	4.5 $\pi^- p \to pX^-$
86.0 $^{+60.0}_{-50.0}$	50	CORDEN	78	OMEG	±	12–15 $\pi^- p \to n\eta 2\pi$
44 ±22		GRASSLER	77	HBC	−	16 $\pi^\mp p \to p\eta 3\pi$
80 to 300		[14] FLATTE	76	RVUE	−	4.2 $K^- p \to \Lambda\eta 2\pi$
16.0 $^{+25.0}_{-16.0}$	70	WELLS	75	HBC	−	3.1–6 $K^- p \to \Lambda\eta 2\pi$
30 ± 5	150	DEFOIX	72	HBC	±	0.7 $\overline{p}p \to 7\pi$
40 ±15		CAMPBELL	69	DBC	±	2.7 $\pi^+ d$
60 ±30	15	MILLER	69B	HBC	−	4.5 $K^- N \to \eta\pi\Lambda$
80 ±30	30	AMMAR	68	HBC	±	5.5 $K^- p \to \Lambda\eta 2\pi$

[11] T-matrix pole.
[12] From a single Breit-Wigner fit.
[13] From $f_1(1285)$ decay.
[14] Using a two-channel resonance parametrization of GAY 76B data.

$K\overline{K}$ ONLY

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
92± 8		[15] ABELE	98	CBAR		0.0 $\overline{p}p \to K_L^0 K^\pm\pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
~ 24		[16] OLLER	99C	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$
~ 25	100	[17] ASTIER	67	HBC	±	
57±13	143	[18] ROSENFELD	65	RVUE	±	

[15] T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.
[16] T-matrix pole.
[17] ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.
[18] Plus systematic errors.

a_0(980) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\eta\pi$	dominant
Γ_2	$K\overline{K}$	seen
Γ_3	$\rho\pi$	
Γ_4	$\gamma\gamma$	seen
Γ_5	e^+e^-	

a_0(980) PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ — Γ_4

VALUE (keV)	*DOCUMENT ID*		*TECN*
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.30 ± 0.10	[19] AMSLER	98	RVUE

[19] Using $\Gamma_{\gamma\gamma}$B(a0(980) $\rightarrow$ $\eta\pi$) =0.24 $\pm$ 0.08 keV.

a_0(980) Γ(i)$\Gamma(\gamma\gamma)/\Gamma$(total)

$\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_1\Gamma_4/\Gamma$

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$0.24^{+0.08}_{-0.07}$ OUR AVERAGE					
$0.28\pm0.04\pm0.10$	44	OEST	90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
$0.19\pm0.07^{+0.10}_{-0.07}$		ANTREASYAN	86	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\eta$

$\Gamma(\eta\pi) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_1\Gamma_5/\Gamma$

VALUE (eV)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<1.5	90	VOROBYEV	88	ND	$e^+e^- \rightarrow \pi^0\eta$

a_0(980) BRANCHING RATIOS

$\Gamma(K\overline{K})/\Gamma(\eta\pi)$ — Γ_2/Γ_1

VALUE	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
0.183±0.024 OUR AVERAGE	Error includes scale factor of 1.2.				
0.57 ± 0.16	[20] BARGIOTTI	03	OBLX		$\overline{p}p$
0.23 ± 0.05	[21] ABELE	98	CBAR		0.0 $\overline{p}p \rightarrow K^0_L K^\pm\pi^\mp$
$0.166\pm0.01\pm0.02$	[22] BARBERIS	98C	OMEG		450 $pp \rightarrow p_f f_1(1285) p_s$

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

~ 0.60	OLLER	99B	RVUE		$\pi\pi \to \eta\pi$, $K\overline{K}$
1.16 ±0.18	[23] BUGG	94	RVUE		$\overline{p}p \to \eta\eta\pi^0$
0.7 ±0.3	[22] CORDEN	78	OMEG		12–15 $\pi^- p \to n\eta 2\pi$
0.25 ±0.08	[22] DEFOIX	72	HBC	±	0.7 $\overline{p} \to 7\pi$

$\Gamma(\rho\pi)/\Gamma(\eta\pi)$ Γ_3/Γ_1

$\rho\pi$ forbidden.

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.25	70	AMMAR	70 HBC	±	4.1,5.5 $K^- p \to \Lambda\eta 2\pi$

[20] Coupled channel analysis of $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, and $K^\pm K^0_S\pi^\mp$.

[21] Using $\pi^0\pi^0\eta$ from AMSLER 94D.

[22] From the decay of $f_1(1285)$.

[23] BUGG 94 uses AMSLER 94C data. This is a ratio of couplings.

$a_0(980)$ REFERENCES

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ACHARD	02B	PL B526 269	P. Achard *et al.*	(L3 Collab.)
ACHASOV	00F	PL B479 53	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
BARBERIS	00H	PL B488 225	D. Barberis *et al.*	(WA 102 Collab.)
OLLER	99	PR D60 099906 (erratum)	J.A. Oller *et al.*	
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TEIGE	99	PR D59 012001	S. Teige *et al.*	(BNL E852 Collab.)
ABELE	98	PR D57 3860	A. Abele *et al.*	(Crystal Barrel Collab.)
ACHASOV	98B	PL B438 441	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
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TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
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ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)
OEST	90	ZPHY C47 343	T. Oest *et al.*	(JADE Collab.)
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev *et al.*	(NOVO)
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ANTREASYAN	86	PR D33 1847	D. Antreasyan *et al.*	(Crystal Ball Collab.)
ATKINSON	84E	PL 138B 459	M. Atkinson *et al.*	(BONN, CERN, GLAS+)
EVANGELISTA	81	NP B178 197	C. Evangelista *et al.*	(BARI, BONN, CERN+)
DEBILLY	80	NP B176 1	L. de Billy *et al.*	(CURIN, LAUS, NEUC+)
GURTU	79	NP B151 181	A. Gurtu *et al.*	(CERN, ZEEM, NIJM, OXF)
CONFORTO	78	LNC 23 419	B. Conforto *et al.*	(RHEL, TNTO, CHIC+)
CORDEN	78	NP B144 253	M.J. Corden *et al.*	(BIRM, RHEL, TELA+)
GRASSLER	77	NP B121 189	H. Grassler *et al.*	(AACH3, BERL, BONN+)
JAFFE	77	PR D15 267,281	R. Jaffe	(MIT)
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)
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WELLS	75	NP B101 333	J. Wells *et al.*	(OXF)
DEFOIX	72	NP B44 125	C. Defoix *et al.*	(CDEF, CERN)
AMMAR	70	PR D2 430	R. Ammar *et al.*	(KANS, NWES, ANL, WISC)
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