$a_0(980)$

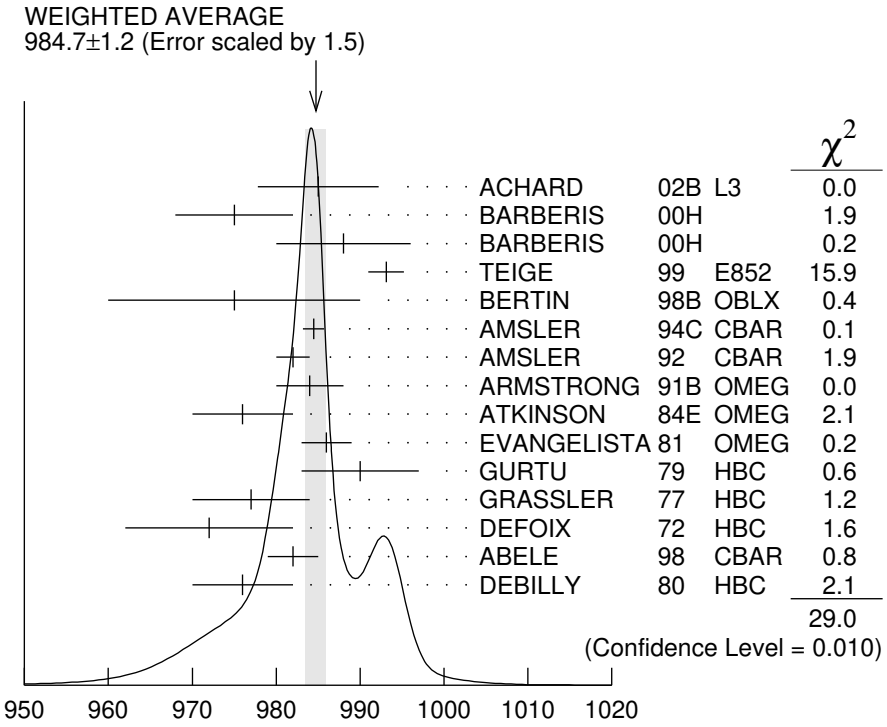
$I^G(J^{PC}) = 1^-(0^{++})$

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.



$\eta\pi$ FINAL STATE ONLY

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

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.						
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 $\overline{p}p \rightarrow K^{\pm} K_s \pi^{\mp}$
984.45	± 1.23 ± 0.34			AMSLER	94C	CBAR	0.0 $\overline{p}p \rightarrow \omega\eta\pi^0$
982	± 2		[2]	AMSLER	92	CBAR	0.0 $\overline{p}p \rightarrow \eta\eta\pi^0$
984	± 4	1040	[2]	ARMSTRONG	91B	OMEG ±	300 $pp \rightarrow pp\eta\pi^+\pi^-$
976	± 6			ATKINSON	84E	OMEG ±	25–55 $\gamma p \rightarrow \eta\pi n$
986	± 3	500	[3]	EVANGELISTA	81	OMEG ±	12 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
990	± 7	145	[3]	GURTU	79	HBC ±	4.2 $K^- p \rightarrow \Lambda\eta 2\pi$
977	± 7			GRASSLER	77	HBC –	16 $\pi^{\mp} p \rightarrow p\eta 3\pi$
972	±10	150		DEFOIX	72	HBC ±	0.7 $\overline{p}p \rightarrow 7\pi$

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

995	$^{+52}_{-10}$	36	[4]	ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
994	$^{+33}_{-8}$	36	[5]	ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
~ 1055			[6]	OLLER	99	RVUE	$\eta\pi$, $K\overline{K}$
~ 1009.2			[6]	OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi$, $K\overline{K}$
988	± 6		[6]	ANISOVICH	98B	RVUE	Compilation
987				TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
991				JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
980	±11	47		CONFORTO	78	OSPK –	4.5 $\pi^- p \rightarrow pX^-$
978	±16	50		CORDEN	78	OMEG ±	12–15 $\pi^- p \rightarrow n\eta 2\pi$
989	± 4	70		WELLS	75	HBC –	3.1–6 $K^- p \rightarrow \Lambda\eta 2\pi$
970	±15	20		BARNES	69C	HBC –	4–5 $K^- p \rightarrow \Lambda\eta 2\pi$
980	±10			CAMPBELL	69	DBC ±	2.7 $\pi^+ d$
980	±10	15		MILLER	69B	HBC –	4.5 $K^- N \rightarrow \eta\pi\Lambda$
980	±10	30		AMMAR	68	HBC ±	5.5 $K^- p \rightarrow \Lambda\eta 2\pi$

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

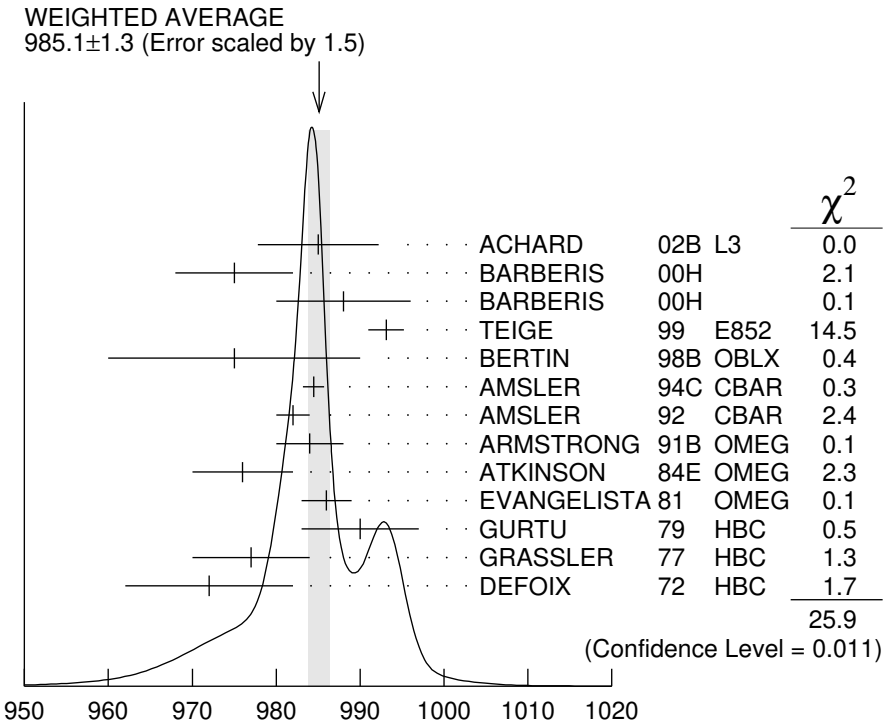
[2] From a single Breit-Wigner fit.

[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		[7] ABELE	98	CBAR		0.0 $\overline{p}p \rightarrow K^0_L K^\pm \pi^\mp$
976 ± 6	316	DEBILLY	80	HBC	±	1.2–2 $\overline{p}p \rightarrow f_1(1285)\omega$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
~ 1053		[8] OLLER	99C	RVUE		$\pi\pi \rightarrow \pi\pi$, $K\overline{K}$
1016 ±10	100	[9] ASTIER	67	HBC	±	0.0 $\overline{p}p$
1003.3± 7.0	143	[10] ROSENFELD	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.

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

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

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

BARGIOTTI	03	EPJ C26 371	M. Bargiotti *et al.*	(OBELIX Collab.)
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.*	
OLLER	99B	NP A652 407 (erratum)	J.A. Oller, E. Oset	
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset	
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.)
AMSLER	98	RMP 70 1293	C. Amsler	
ANISOVICH	98B	UFN 41 419	V.V. Anisovich *et al.*	
BARBERIS	98C	PL B440 225	D. Barberis *et al.*	(WA 102 Collab.)
BERTIN	98B	PL B434 180	A. Bertin *et al.*	(OBELIX Collab.)
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
JANSSEN	95	PR D52 2690	G. Janssen *et al.*	(STON, ADLD, JULI)
AMSLER	94C	PL B327 425	C. Amsler *et al.*	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler *et al.*	(Crystal Barrel Collab.)
BUGG	94	PR D50 4412	D.V. Bugg *et al.*	(LOQM)
AMSLER	92	PL B291 347	C. Amsler *et al.*	(Crystal Barrel Collab.)
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 Translated from YAF 48 436.	P.V. Vorobiev *et al.*	(NOVO)
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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)
GAY	76B	PL 63B 220	J.B. Gay *et al.*	(CERN, AMST, NIJM) JP
WELLS	75	NP B101 333	J. Wells *et al.*	(OXF)
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AMMAR	70	PR D2 430	R. Ammar *et al.*	(KANS, NWES, ANL, WISC)
BARNES	69C	PRL 23 610	V.E. Barnes *et al.*	(BNL, SYRA)

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CLOSE	01	PL B515 13	F.E. Close, A. Kirk	
ANISOVICH	99D	PL B452 180	A.V. Anisovich *et al.*	
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MARCO	99	PL B470 20	E. Marco *et al.*	
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TORNQVIST	90	NPBPS 21 196	N.A. Tornqvist	(HELS)
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