

# a<sub>0</sub>(980)

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

See the related review(s):  
 Scalar Mesons below 1 GeV

## a<sub>0</sub>(980) T-MATRIX POLE $\sqrt{s}$

Note that  $\Gamma = -2 \text{Im}(\sqrt{s})$ .

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>(970–1020) – i (30–70) OUR ESTIMATE</b> (see Fig. 64.2 in the review)			
(1002.4 ± 1.4 ± 6.6) – i(63.5 ± 2.9)	<sup>1</sup> ALBRECHT	20 CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$ , $\pi^0 \eta \eta$ , $\pi^0 K^+ K^-$
(1000.7 <sup>+12.9</sup> <sub>–0.7</sub> ) – i(36.6 <sup>+12.7</sup> <sub>–2.6</sub> )	<sup>2</sup> LU	20 RVUE	$\gamma\gamma \rightarrow \pi^0 \eta$ , $K_S^0 K_S^0$
(989 ± 5) – i(40 ± 5)	<sup>3</sup> BUGG	08A RVUE	$\bar{p}p$ annihilation data
(1117 <sup>+24</sup> <sub>–320</sub> ) – i(12 <sup>+43</sup> <sub>–12</sub> )	<sup>4</sup> PELAEZ	04A RVUE	$\pi\pi \rightarrow \pi\pi$ , $\pi K \rightarrow \pi K$
(982 ± 3) – i(46 ± 4)	<sup>5</sup> ABELE	98 CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$

<sup>1</sup> Pole mass on sheet closest to the physical axis - the more remote pole is extracted at (1004.1 ± 1.5 ± 6.5) – i(48.6 ± 1.2 ± 3.4) MeV.

<sup>2</sup> T-matrix pole on sheet II.

<sup>3</sup> T-matrix pole on sheet II. Parameterizes couplings to  $\bar{K}K$ ,  $\pi\eta$ , and  $\pi\eta'$ . Uses AM-SLER 94D and ABELE 98.

<sup>4</sup> Reanalysis of data from LINGLIN 73, ESTABROOKS 78, and ASTON 88 in the unitarized ChPT model.

<sup>5</sup> T-matrix pole on sheet II; the pole on sheet III is at (1006 – i 49) MeV.

## a<sub>0</sub>(980) MASS

VALUE (MeV)	DOCUMENT ID
<b>980 ± 20 OUR ESTIMATE</b>	Mass determination very model dependent

### ηπ FINAL STATE ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
982.5 ± 1.6 ± 1.1	16.9k	<sup>1</sup> AMBROSINO	09F KLOE		1.02 $e^+ e^- \rightarrow \eta \pi^0 \gamma$
986 ± 4		ANISOVICH	09 RVUE		0.0 $\bar{p}p$ , $\pi N$
982.3 <sup>+0.6</sup> <sub>–0.7</sub> <sup>+3.1</sup> <sub>–4.7</sub>		<sup>2</sup> UEHARA	09A BELL		$\gamma\gamma \rightarrow \pi^0 \eta$
985 ± 4 ± 6	318	ACHARD	02B L3		183–209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
995 <sup>+52</sup> <sub>–10</sub>	36	<sup>3</sup> ACHASOV	00F SND		$e^+ e^- \rightarrow \eta \pi^0 \gamma$
994 <sup>+33</sup> <sub>–8</sub>	36	<sup>4</sup> ACHASOV	00F SND		$e^+ e^- \rightarrow \eta \pi^0 \gamma$
975 ± 7		BARBERIS	00H		450 $pp \rightarrow p_f \eta \pi^0 p_s$
988 ± 8		BARBERIS	00H		450 $pp \rightarrow \Delta_f^{++} \eta \pi^- p_s$
~ 1055		<sup>5</sup> OLLER	99 RVUE		$\eta \pi$ , $K \bar{K}$

$\sim 1009.2$		<sup>5</sup> OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$993.1 \pm 2.1$		<sup>6</sup> TEIGE	99	B852	$18.3 \pi^- p \rightarrow \eta\pi^+\pi^- n$
$988 \pm 6$		<sup>5</sup> ANISOVICH	98B	RVUE	Compilation
987		TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
991		JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi, \eta\pi$
$984.45 \pm 1.23 \pm 0.34$		AMSLER	94C	CBAR	$0.0 \bar{p}p \rightarrow \omega\eta\pi^0$
$982 \pm 2$		<sup>7</sup> AMSLER	92	CBAR	$0.0 \bar{p}p \rightarrow \eta\eta\pi^0$
$984 \pm 4$	1040	<sup>7</sup> ARMSTRONG	91B	OMEG $\pm$	$300 pp \rightarrow p\rho\eta\pi^+\pi^-$
$976 \pm 6$		ATKINSON	84E	OMEG $\pm$	$25-55 \gamma p \rightarrow \eta\pi n$
$986 \pm 3$	500	<sup>8</sup> EVANGELIS...	81	OMEG $\pm$	$12 \pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
$990 \pm 7$	145	<sup>8</sup> GURTU	79	HBC $\pm$	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
$980 \pm 11$	47	CONFORTO	78	OSPK $-$	$4.5 \pi^- p \rightarrow pX^-$
$978 \pm 16$	50	CORDEN	78	OMEG $\pm$	$12-15 \pi^- p \rightarrow n\eta 2\pi$
$977 \pm 7$		GRASSLER	77	HBC $-$	$16 \pi^\mp p \rightarrow p\eta 3\pi$
$989 \pm 4$	70	WELLS	75	HBC $-$	$3.1-6 K^- p \rightarrow \Lambda\eta 2\pi$
$972 \pm 10$	150	DEFOIX	72	HBC $\pm$	$0.7 \bar{p}p \rightarrow 7\pi$
$970 \pm 15$	20	BARNES	69C	HBC $-$	$4-5 K^- p \rightarrow \Lambda\eta 2\pi$
$980 \pm 10$		CAMPBELL	69	DBC $\pm$	$2.7 \pi^+ d$
$980 \pm 10$	15	MILLER	69B	HBC $-$	$4.5 K^- N \rightarrow \eta\pi\Lambda$
$980 \pm 10$	30	AMMAR	68	HBC $\pm$	$5.5 K^- p \rightarrow \Lambda\eta 2\pi$

<sup>1</sup> Using the model of ACHASOV 89 and ACHASOV 03B.

<sup>2</sup> From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

<sup>3</sup> Using the model of ACHASOV 89. Supersedes ACHASOV 98B.

<sup>4</sup> Using the model of JAFFE 77. Supersedes ACHASOV 98B.

<sup>5</sup> T-matrix pole.

<sup>6</sup> Breit-Wigner fit, average between  $a_0^\pm$  and  $a_0^0$ . The fit favors a slightly heavier  $a_0^\pm$ .

<sup>7</sup> From a single Breit-Wigner fit.

<sup>8</sup> From  $f_1(1285)$  decay.

## **$K\bar{K}$ ONLY**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$947.7^+_{-5.0} \pm 6.6$		<sup>1</sup> AAIJ	19H LHCb	$p p \rightarrow D^\pm X$
$925 \pm 5 \pm 8$	190k	<sup>2</sup> AAIJ	16N LHCb	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
$\sim 1053$		<sup>3</sup> OLLER	99C RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$975 \pm 15$		BERTIN	98B OBLX	$0.0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
$970 \pm 10$	316	DEBILLY	80 HBC	$1.2-2 \bar{p}p \rightarrow f_1(1285)\omega$
$1016 \pm 10$	100	<sup>4</sup> ASTIER	67 HBC	$0.0 \bar{p}p$
$1003.3 \pm 7.0$	143	<sup>5,6</sup> ROSENFELD	65 RVUE	

- <sup>1</sup> From the  $D^\pm \rightarrow K^\pm K^+ K^-$  Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUDE 18.
- <sup>2</sup> Using a two-channel resonance parametrization with couplings fixed to ABELE 98.
- <sup>3</sup> T-matrix pole.
- <sup>4</sup> ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.
- <sup>5</sup> Note on  $J^P$ . Main argument for  $0^+$  is small  $Q$  value. Isotropy of decay distribution in  $\bar{p}p$  at rest proves nothing. See discussion by Rosenfeld (Oxford) and Butterworth (Heidelberg).
- <sup>6</sup> Plus systematic errors.

## $a_0(980)$ WIDTH

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
<b>50 to 100 OUR ESTIMATE</b>		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. ● ● ●					
$75.6 \pm 1.6$		<sup>1</sup> UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
$50 \pm 13$	$\pm 4$	318	ACHARD	02B L3	$183-209 e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
72	$\pm 16$		BARBERIS	00H	$450 p p \rightarrow p_f \eta \pi^0 p_s$
61	$\pm 19$		BARBERIS	00H	$450 p p \rightarrow \Delta_f^{++} \eta \pi^- p_s$
$\sim 42$		<sup>2</sup> OLLER	99	RVUE	$\eta\pi, K\bar{K}$
$\sim 112$		<sup>2</sup> OLLER	99B	RVUE	$\pi\pi \rightarrow \eta\pi, K\bar{K}$
71	$\pm 7$		TEIGE	99 B852	$18.3 \pi^- p \rightarrow \eta\pi^+ \pi^- n$
92	$\pm 20$	<sup>2</sup> ANISOVICH	98B	RVUE	Compilation
65	$\pm 10$	<sup>3</sup> BERTIN	98B	OBLX $\pm$	$0.0 \bar{p}p \rightarrow K^\pm K_s \pi^\mp$
$\sim 100$		TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
202		JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi, \eta\pi$
$54.12 \pm 0.34 \pm 0.12$		AMSLER	94C	CBAR	$0.0 \bar{p}p \rightarrow \omega\eta\pi^0$
54	$\pm 10$	<sup>4</sup> AMSLER	92	CBAR	$0.0 \bar{p}p \rightarrow \eta\eta\pi^0$
95	$\pm 14$	1040	<sup>4</sup> ARMSTRONG	91B OMEG $\pm$	$300 p p \rightarrow p p \eta \pi^+ \pi^-$
62	$\pm 15$	500	<sup>5</sup> EVANGELIS...	81 OMEG $\pm$	$12 \pi^- p \rightarrow \eta\pi^+ \pi^- \pi^- p$
60	$\pm 20$	145	<sup>5</sup> GURTU	79 HBC $\pm$	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
60	$\begin{smallmatrix} +50 \\ -30 \end{smallmatrix}$	47	CONFORTO	78 OSPK $-$	$4.5 \pi^- p \rightarrow p\chi^-$
86.0	$\begin{smallmatrix} +60.0 \\ -50.0 \end{smallmatrix}$	50	CORDEN	78 OMEG $\pm$	$12-15 \pi^- p \rightarrow n\eta 2\pi$
44	$\pm 22$		GRASSLER	77 HBC $-$	$16 \pi^\mp p \rightarrow p\eta 3\pi$
80	to 300		<sup>6</sup> FLATTE	76 RVUE $-$	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
16.0	$\begin{smallmatrix} +25.0 \\ -16.0 \end{smallmatrix}$	70	<sup>7</sup> WELLS	75 HBC $-$	$3.1-6 K^- p \rightarrow \Lambda\eta 2\pi$
30	$\pm 5$	150	<sup>8</sup> DEFOIX	72 HBC $\pm$	$0.7 \bar{p}p \rightarrow 7\pi$
40	$\pm 15$		CAMPBELL	69 DBC $\pm$	$2.7 \pi^+ d$
60	$\pm 30$	15	MILLER	69B HBC $-$	$4.5 K^- N \rightarrow \eta\pi\Lambda$
80	$\pm 30$	30	AMMAR	68 HBC $\pm$	$5.5 K^- p \rightarrow \Lambda\eta 2\pi$

- <sup>1</sup> From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.
- <sup>2</sup> T-matrix pole.
- <sup>3</sup> The  $\eta\pi$  width.
- <sup>4</sup> From a single Breit-Wigner fit.
- <sup>5</sup> From  $f_1(1285)$  decay.
- <sup>6</sup> Using a two-channel resonance parametrization of GAY 76B data.
- <sup>7</sup> Weak evidence only for  $a_0(980)^+$  production.
- <sup>8</sup> This number has very little meaning. Error is much too small. Vlada

**$K\bar{K}$  ONLY**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
~ 48		<sup>1</sup> OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
~ 25	100	<sup>2</sup> ASTIER	67	HBC	$\pm$
$57 \pm 13$	143	<sup>3</sup> ROSENFELD	65	RVUE	$\pm$
<sup>1</sup> T-matrix pole.					
<sup>2</sup> ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.					
<sup>3</sup> Plus systematic errors.					

**$a_0(980)$  DECAY MODES**

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $\eta\pi$	seen
$\Gamma_2$ $K\bar{K}$	seen
$\Gamma_3$ $\eta'\pi$	seen
$\Gamma_4$ $\rho\pi$	not seen
$\Gamma_5$ $\gamma\gamma$	seen
$\Gamma_6$ $e^+e^-$	

**$a_0(980)$  PARTIAL WIDTHS**

**$\Gamma(\gamma\gamma)$   $\Gamma_5$**

VALUE (keV)	DOCUMENT ID	TECN
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●		
$0.30 \pm 0.10$	<sup>1</sup> AMSLER	98 RVUE
<sup>1</sup> Using $\Gamma_{\gamma\gamma} B(a_0(980) \rightarrow \eta\pi) = 0.24 \pm 0.08$ keV.		

**$a_0(980)$   $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$**

**$\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_1\Gamma_5/\Gamma$**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>0.21^{+0.08}_{-0.04}</math> OUR AVERAGE</b>				
$0.128^{+0.003+0.502}_{-0.002-0.043}$		<sup>1</sup> UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0\eta$
$0.28 \pm 0.04 \pm 0.10$	44	OEST	90 JADE	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
$0.19 \pm 0.07^{+0.10}_{-0.07}$		ANTREASYAN 86	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\eta$

<sup>1</sup> From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

$\Gamma(\eta\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_6/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.5	90	VOROBYEV	88	ND	$e^+e^- \rightarrow \pi^0\eta$

### $a_0(980)$ BRANCHING RATIOS

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$					$\Gamma_2/\Gamma_1$
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
<b>0.172±0.019 OUR AVERAGE</b>					
0.137±0.036±0.042	<sup>1</sup> ABLIKIM	22AH	BES3	$D_s^+ \rightarrow K_S^0 K^+ \pi^0$	
0.23 ±0.05	<sup>2</sup> ABELE	98	CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$	
0.166±0.01 ±0.02	<sup>3</sup> BARBERIS	98C	OMEG	$450 p p \rightarrow p_f f_1(1285) p_S$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.138±0.001±0.035	<sup>4</sup> ALBRECHT	20	CBAR	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$	
1.20 ±0.15	<sup>5</sup> ANISOVICH	09	RVUE	$0.0 \bar{p}p, \pi N$	
1.05 ±0.07 ±0.05	<sup>6</sup> BUGG	08A	RVUE	0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$	
0.57 ±0.16	<sup>7</sup> BARGIOTTI	03	OBLX	$\bar{p}p$	
~0.60	OLLER	99B	RVUE	$\pi\pi \rightarrow \eta\pi, K\bar{K}$	
0.7 ±0.3	<sup>3</sup> CORDEN	78	OMEG	$12-15 \pi^- p \rightarrow n\eta 2\pi$	
0.25 ±0.08	<sup>3</sup> DEFOIX	72	HBC	± $0.7 \bar{p} \rightarrow 7\pi$	

<sup>1</sup> Using  $D_s^+ \rightarrow a_0(980)^+ \pi^0$  from ABLIKIM 19BE.

<sup>2</sup> Using  $\pi^0 \pi^0 \eta$  from AMSLER 94D.

<sup>3</sup> From the decay of  $f_1(1285)$ .

<sup>4</sup> Residues from T-matrix pole with 2 poles, 2 channels. Solution on adjacent sheet  $0.149 \pm 0.001 \pm 0.039$ .

<sup>5</sup> This is a ratio of couplings.

<sup>6</sup> A ratio of couplings, using AMSLER 94D and ABELE 98. Supersedes BUGG 94.

<sup>7</sup> Coupled channel analysis of  $\pi^+ \pi^- \pi^0, K^+ K^- \pi^0,$  and  $K^\pm K_S^0 \pi^\mp$ .

$\Gamma(\eta'\pi)/\Gamma_{\text{total}}$					$\Gamma_3/\Gamma$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
<b>seen</b>	116k	<sup>1</sup> CHEN	20A	BELL	$D^0 \rightarrow K^- \pi^+ \eta$

<sup>1</sup> From an amplitude analysis of the  $D^0 \rightarrow K^- \pi^+ \eta$  decay in a three-channel Flatte model with a 10.1  $\sigma$  significance. Earlier observed by ABLIKIM 17K in the  $\chi_{c1} \rightarrow \eta \pi^+ \pi^-$  decay with a 8.9  $\sigma$  significance.

$\Gamma(\rho\pi)/\Gamma(\eta\pi)$					$\Gamma_4/\Gamma_1$
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.25	70	<sup>1</sup> AMMAR	70	HBC	± $4.1, 5.5 K^- p \rightarrow \Lambda \eta 2\pi$

$\rho\pi$  forbidden.

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

<sup>1</sup> Not clear if they really observed the  $a_0(980)$  3 standard deviations.

## $a_0(980)$ REFERENCES

ABLIKIM	22AH	PRL 129 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
CHEN	20A	PR D102 012002	Y.Q. Chen <i>et al.</i>	(BELLE Collab.)
LU	20	EPJ C80 436	J. Lu, B. Moussallam	
AAIJ	19H	JHEP 1904 063	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	19BE	PRL 123 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AOUDE	18	PR D98 056021	R.T. Aoude <i>et al.</i>	
ABLIKIM	17K	PR D95 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)
BUGG	08A	PR D78 074023	D.V. Bugg	(LOQM)
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	(MADU)
ACHASOV	03B	PR D68 014006	N.N. Achasov, A.V. Kiselev	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
OLLER	99	PR D60 099906 (errat.)	J.A. Oller <i>et al.</i>	
OLLER	99B	NP A652 407 (errat.)	J.A. Oller, E. Oset	
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset	
TEIGE	99	PR D59 012001	S. Teige <i>et al.</i>	(BNL E852 Collab.)
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AMSLER	98	RMP 70 1293	C. Amsler	
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
		Translated from UFN 168 481.		
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
JANSSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
		Translated from YAF 48 436.		
ANTREASYAN	86	PR D33 1847	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
DEBILLY	80	NP B176 1	L. de Billy <i>et al.</i>	(CURIN, LAUS, NEUC+)
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)
CONFORTO	78	LNC 23 419	B. Conforto <i>et al.</i>	(RHEL, TNTO, CHIC+)
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(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 <i>et al.</i>	(CERN, AMST, NIJM) JP
WELLS	75	NP B101 333	J. Wells <i>et al.</i>	(OXF)
LINGLIN	73	NP B55 408	D. Linglin	(CERN)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
AMMAR	70	PR D2 430	R. Ammar <i>et al.</i>	(KANS, NWES, ANL, WISC)
BARNES	69C	PRL 23 610	V.E. Barnes <i>et al.</i>	(BNL, SYRA)
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)
MILLER	69B	PL 29B 255	D.H. Miller <i>et al.</i>	(PURD)
		Also PR 188 2011	W.L. Yen <i>et al.</i>	(PURD)
AMMAR	68	PRL 21 1832	R. Ammar <i>et al.</i>	(NWES, ANL)
ASTIER	67	PL 25B 294	A. Astier <i>et al.</i>	(CDEF, CERN, IRAD)
		Includes data of BARLOW 67, CONFORTO 67, and ARMENTEROS 65.		
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIVP)
CONFORTO	67	NP B3 469	G. Conforto <i>et al.</i>	(CERN, CDEF, IPNP+)

ARMENTEROS 65	PL 17 344	R. Armenteros <i>et al.</i>	(CERN, CDEF)
ROSENFELD 65	Oxford Conf. 58	A.H. Rosenfeld	(LRL)

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