# $\rho(1450)$

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

See the mini-review under the $\rho(1700)$.

## $\rho(1450)$ MASS

| *VALUE* (MeV) | *DOCUMENT ID* |
|---|---|

**1465±25 OUR ESTIMATE** This is only an educated guess; the error given is larger than the error on the average of the published values.

**1452± 8 OUR AVERAGE** Includes data from the 2 datablocks that follow this one.

### $\eta\rho^0$ MODE

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| The data in this block is included in the average printed for a previous datablock. | | | | |
| 1470±20 | ANTONELLI | 88 | DM2 | $e^+e^- \to \eta\pi^+\pi^-$ |
| 1446±10 | FUKUI | 88 | SPEC | 8.95 $\pi^- p \to \eta\pi^+\pi^- n$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 1497±14 | [13] AKHMETSHIN | 01B | CMD2 | $e^+e^- \to \eta\gamma$ |
| 1421±15 | [1] AKHMETSHIN | 00D | CMD2 | $e^+e^- \to \eta\pi^+\pi^-$ |

[1] Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

### $\omega\pi$ MODE

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|---|
| The data in this block is included in the average printed for a previous datablock. | | | | | |
| 1463±25 | | [14] CLEGG | 94 | RVUE | |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $1349\pm25\,^{+10}_{-5}$ | 341 | [2] ALEXANDER | 01B | CLE2 | $B \to D^{(*)}\omega\pi^-$ |
| 1523±10 | | [3] EDWARDS | 00A | CLE2 | $\tau^- \to \omega\pi^-\nu_\tau$ |
| 1250 | | [4] ASTON | 80C | OMEG | 20–70 $\gamma p \to \omega\pi^0 p$ |
| 1290±40 | | [4] BARBER | 80C | SPEC | 3–5 $\gamma p \to \omega\pi^0 p$ |

[2] Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

[3] Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

[4] Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

### $4\pi$ MODE

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 1435±40 | ABELE | 01B | CBAR | 0.0 $\bar{p}n \to 2\pi^-2\pi^0\pi^+$ |
| 1350±50 | ACHASOV | 97 | RVUE | $e^+e^- \to 2(\pi^+\pi^-)$ |
| 1449± 4 | [5] ARMSTRONG | 89E | OMEG | 300 $pp \to pp2(\pi^+\pi^-)$ |

[5] Not clear whether this observation has $I$=1 or 0.

## $\pi\pi$ MODE

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $1406 \pm 15$ | 87k | [6,15] ANDERSON | 00A | CLE2 | $\tau^- \to \pi^- \pi^0 \nu_\tau$ |
| $\sim 1368$ | | [7] ABELE | 99C | CBAR | 0.0 $\overline{p} d \to \pi^+ \pi^- \pi^- p$ |
| $1348 \pm 33$ | | BERTIN | 98 | OBLX | 0.05–0.405 $\overline{n} p \to \pi^+ \pi^+ \pi^-$ |
| $1411 \pm 14$ | | [8] ABELE | 97 | CBAR | $\overline{p} n \to \pi^- \pi^0 \pi^0$ |
| $1370^{+90}_{-70}$ | | ACHASOV | 97 | RVUE | $e^+ e^- \to \pi^+ \pi^-$ |
| $1380 \pm 24$ | | [16] BARATE | 97M | ALEP | $\tau^- \to \pi^- \pi^0 \nu_\tau$ |
| $1359 \pm 40$ | | [15] BERTIN | 97C | OBLX | 0.0 $\overline{p} p \to \pi^+ \pi^- \pi^0$ |
| $1282 \pm 37$ | | BERTIN | 97D | OBLX | 0.05 $\overline{p} p \to 2\pi^+ 2\pi^-$ |
| $1424 \pm 25$ | | BISELLO | 89 | DM2 | $e^+ e^- \to \pi^+ \pi^-$ |
| $1292 \pm 17$ | | [9] KURDADZE | 83 | OLYA | 0.64–1.4 $e^+ e^- \to \pi^+ \pi^-$ |

[6] From the GOUNARIS 68 parametrization of the pion form factor.
[7] $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.
[8] T-matrix pole.
[9] Using for $\rho(1700)$ mass and width 1600 $\pm$ 20 and 300 $\pm$ 10 MeV respectively.

## $\phi\pi$ MODE

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $1480 \pm 40$ | [10,11] BITYUKOV | 87 | SPEC | 0 | 32.5 $\pi^- p \to \phi \pi^0 n$ |

[10] DONNACHIE 91 suggests this is a different particle.
[11] Not seen by ABELE 97H.

## $K\overline{K}$ MODE

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| $1422.8 \pm 6.5$ | 27k | [12] ABELE | 99D | CBAR | $\pm$ | 0.0 $\overline{p} p \to K^+ K^- \pi^0$ |

[12] K-matrix pole. Isospin not determined, could be $\omega(1420)$.

## MIXED MODES

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $1265.5 \pm 75.3$ | DUBNICKA | 89 | RVUE | $e^+ e^- \to \pi^+ \pi^-$ |

[13] Using the data of AKHMETSHIN 01B on $e^+ e^- \to \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+ e^- \to \eta \pi^+ \pi^-$.
[14] Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.
[15] $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.
[16] Fixing $\rho(1450)$ width to 310 MeV and $\rho(1700)$ mass and width to 1700 MeV and 235 MeV respectively.

# $\rho(1450)$ WIDTH

| *VALUE* (MeV) | *DOCUMENT ID* |
|---|---|
| **310±60 OUR ESTIMATE** This is only an educated guess; the error given is larger than the error on the average of the published values. | |

## $\eta\rho^0$ MODE

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 226±44 | [27] AKHMETSHIN | 01B | CMD2 | $e^+e^- \to \eta\gamma$ |
| 211±31 | [17] AKHMETSHIN | 00D | CMD2 | $e^+e^- \to \eta\pi^+\pi^-$ |
| 230±30 | ANTONELLI | 88 | DM2 | $e^+e^- \to \eta\pi^+\pi^-$ |
| 60±15 | FUKUI | 88 | SPEC | 8.95 $\pi^- p \to \eta\pi^+\pi^- n$ |

[17] Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

## $\omega\pi$ MODE

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|---|
| The data in this block is included in the average printed for a previous datablock. | | | | | |
| 311± 62 | | [28] CLEGG | 94 | RVUE | |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 547± 86$^{+46}_{-45}$ | 341 | [18] ALEXANDER | 01B | CLE2 | $B \to D^{(*)}\omega\pi^-$ |
| 400± 35 | | [19] EDWARDS | 00A | CLE2 | $\tau^- \to \omega\pi^-\nu_\tau$ |
| 300 | | [20] ASTON | 80C | OMEG | 20–70 $\gamma p \to \omega\pi^0 p$ |
| 320±100 | | [20] BARBER | 80C | SPEC | 3–5 $\gamma p \to \omega\pi^0 p$ |

[18] Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.
[19] Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.
[20] Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

## $4\pi$ MODE

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 325±100 | ABELE | 01B | CBAR | 0.0 $\overline{p}n \to 2\pi^-2\pi^0\pi^+$ |

## $\pi\pi$ MODE

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 455±41 | 87k | [21,29] ANDERSON | 00A | CLE2 | $\tau^- \to \pi^-\pi^0\nu_\tau$ |
| ∼ 374 | | [22] ABELE | 99C | CBAR | 0.0 $\overline{p}d \to \pi^+\pi^-\pi^- p$ |
| 275±10 | | BERTIN | 98 | OBLX | 0.05–0.405 $\overline{n}p \to \pi^+\pi^+\pi^-$ |
| 343±20 | | [30] ABELE | 97 | CBAR | $\overline{p}n \to \pi^-\pi^0\pi^0$ |
| 310±40 | | [29] BERTIN | 97C | OBLX | 0.0 $\overline{p}p \to \pi^+\pi^-\pi^0$ |
| 236±36 | | BERTIN | 97D | OBLX | 0.05 $\overline{p}p \to 2\pi^+2\pi^-$ |
| 269±31 | | BISELLO | 89 | DM2 | $e^+e^- \to \pi^+\pi^-$ |
| 218±46 | | [23] KURDADZE | 83 | OLYA | 0.64–1.4 $e^+e^- \to \pi^+\pi^-$ |

[21] From the GOUNARIS 68 parametrization of the pion form factor.
[22] $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.
[23] Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

### $\phi\pi$ MODE

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $130 \pm 60$ | [24,25] BITYUKOV | 87 | SPEC | 0 | 32.5 $\pi^- p \rightarrow \phi \pi^0 n$ |

[24] DONNACHIE 91 suggests this is a different particle.
[25] Not seen by ABELE 97H.

### $K\overline{K}$ MODE

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| $146.5 \pm 10.5$ | 27k | [26] ABELE | 99D | CBAR | $\pm$ | 0.0 $\overline{p} p \rightarrow K^+ K^- \pi^0$ |

[26] K-matrix pole. Isospin not determined, could be $\omega(1420)$.

### MIXED MODES

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $391 \pm 70$ | DUBNICKA | 89 | RVUE | $e^+ e^- \rightarrow \pi^+ \pi^-$ |

[27] Using the data of AKHMETSHIN 01B on $e^+ e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+ e^- \rightarrow \eta \pi^+ \pi^-$.
[28] Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.
[29] $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.
[30] T-matrix pole.

## $\rho(1450)$ DECAY MODES

| | Mode | Fraction ($\Gamma_i/\Gamma$) | Confidence level |
|---|---|---|---|
| $\Gamma_1$ | $\pi\pi$ | seen | |
| $\Gamma_2$ | $4\pi$ | seen | |
| $\Gamma_3$ | $\omega\pi$ | $<2.0$ % | 95% |
| $\Gamma_4$ | $a_1(1260)\pi$ | | |
| $\Gamma_5$ | $h_1(1170)\pi$ | | |
| $\Gamma_6$ | $\pi(1300)\pi$ | | |
| $\Gamma_7$ | $\rho\rho$ | | |
| $\Gamma_8$ | $\rho(\pi\pi)_{S\text{-wave}}$ | | |
| $\Gamma_9$ | $e^+ e^-$ | seen | |
| $\Gamma_{10}$ | $\eta\rho$ | $<4$ % | |
| $\Gamma_{11}$ | $a_2(1320)\pi$ | not seen | |
| $\Gamma_{12}$ | $\phi\pi$ | $<1$ % | |
| $\Gamma_{13}$ | $K\overline{K}$ | $<1.6 \times 10^{-3}$ | 95% |
| $\Gamma_{14}$ | $\eta\gamma$ | possibly seen | |

## $\rho(1450)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(total)$

### $\Gamma(\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_1\Gamma_9/\Gamma$

| VALUE (keV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.12 | [31] DIEKMAN | 88 | RVUE | $e^+e^- \to \pi^+\pi^-$ |
| $0.027^{+0.015}_{-0.010}$ | [32] KURDADZE | 83 | OLYA | 0.64–1.4 $e^+e^- \to \pi^+\pi^-$ |

### $\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{10}\Gamma_9/\Gamma$

| VALUE (eV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **91±19** | ANTONELLI | 88 | DM2 | $e^+e^- \to \eta\pi^+\pi^-$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 74±20 | [33] AKHMETSHIN | 00D | CMD2 | $e^+e^- \to \eta\pi^+\pi^-$ |

### $\Gamma(\phi\pi) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{12}\Gamma_9/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<70** | 90 | [34] AULCHENKO | 87B | ND | $e^+e^- \to K^0_S K^0_L \pi^0$ |

### $\Gamma(\eta\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{14}\Gamma_9/\Gamma$

| VALUE (units $10^{-9}$) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 10.0±2.2±1.5 | [35] AKHMETSHIN | 01B | CMD2 | $e^+e^- \to \eta\gamma$ |

[31] Using total width = 235 MeV.
[32] Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.
[33] Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.
[34] Using mass 1480 ± 40 MeV and total width 130 ± 60 MeV of BITYUKOV 87.
[35] Using the data of AKHMETSHIN 01B on $e^+e^- \to \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \to \eta\pi^+\pi^-$.

## $\rho(1450)$ BRANCHING RATIOS

### $\Gamma(\eta\rho)/\Gamma_{total}$ $\Gamma_{10}/\Gamma$

| VALUE | DOCUMENT ID | | TECN |
|---|---|---|---|
| **<0.04** | DONNACHIE | 87B | RVUE |

### $\Gamma(a_2(1320)\pi)/\Gamma_{total}$ $\Gamma_{11}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| not seen | AMELIN | 00 | VES | 37 $\pi^- p \to \eta\pi^+\pi^- n$ |

### $\Gamma(\phi\pi)/\Gamma(\omega\pi)$ $\Gamma_{12}/\Gamma_3$

| VALUE | CL% | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|---|
| **>0.5** | 95 | BITYUKOV | 87 | SPEC | 0 | 32.5 $\pi^- p \to \phi\pi^0 n$ |

### $\Gamma(\omega\pi)/\Gamma(4\pi)$ $\Gamma_3/\Gamma_2$

| VALUE | DOCUMENT ID | | TECN |
|---|---|---|---|
| **<0.14** | CLEGG | 88 | RVUE |

### $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ $\Gamma_4/\Gamma_2$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.27±0.08 | [36] ABELE | 01B | CBAR | 0.0 $\overline{p}n \rightarrow 5\pi$ |

### $\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$ $\Gamma_5/\Gamma_2$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.08±0.04 | [36] ABELE | 01B | CBAR | 0.0 $\overline{p}n \rightarrow 5\pi$ |

### $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ $\Gamma_6/\Gamma_2$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.37±0.13 | [36] ABELE | 01B | CBAR | 0.0 $\overline{p}n \rightarrow 5\pi$ |

### $\Gamma(\rho\rho)/\Gamma(4\pi)$ $\Gamma_7/\Gamma_2$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.11±0.05 | [36] ABELE | 01B | CBAR | 0.0 $\overline{p}n \rightarrow 5\pi$ |

### $\Gamma(\rho(\pi\pi)_{S\text{-wave}})/\Gamma(4\pi)$ $\Gamma_8/\Gamma_2$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.17±0.09 | [36] ABELE | 01B | CBAR | 0.0 $\overline{p}n \rightarrow 5\pi$ |

### $\Gamma(\pi\pi)/\Gamma(4\pi)$ $\Gamma_1/\Gamma_2$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.37±0.10 | [36,37] ABELE | 01B | CBAR | 0.0 $\overline{p}n \rightarrow 5\pi$ |

### $\Gamma(\eta\rho)/\Gamma(\omega\pi)$ $\Gamma_{10}/\Gamma_3$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| ~ 0.24 | [38] DONNACHIE | 91 | RVUE | |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| >2 | FUKUI | 91 | SPEC | 8.95 $\pi^- p \rightarrow \omega\pi^0 n$ |

### $\Gamma(\omega\pi)/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma$

| VALUE | DOCUMENT ID | | TECN |
|---|---|---|---|
| ~ 0.21 | CLEGG | 94 | RVUE |

### $\Gamma(\pi\pi)/\Gamma(\omega\pi)$ $\Gamma_1/\Gamma_3$

| VALUE | DOCUMENT ID | | TECN |
|---|---|---|---|
| ~ 0.32 | CLEGG | 94 | RVUE |

## $\Gamma(\phi\pi)/\Gamma_{total}$ $\Gamma_{12}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **<0.01** | [38] DONNACHIE | 91 | RVUE | |

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

| | | | | |
|---|---|---|---|---|
| not seen | ABELE | 97H | CBAR | $\overline{p}p \rightarrow K^0_L K^0_S \pi^0 \pi^0$ |

## $\Gamma(K\overline{K})/\Gamma(\omega\pi)$ $\Gamma_{13}/\Gamma_3$

| VALUE | DOCUMENT ID | | TECN |
|---|---|---|---|
| **<0.08** | [38] DONNACHIE | 91 | RVUE |

[36] $\omega\pi$ not included.
[37] Using ABELE 97.
[38] Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

## $\rho(1450)$ REFERENCES


| | | | | |
|---|---|---|---|---|
| ABELE | 01B | EPJ C21 261 | A. Abele *et al.* | (Crystal Barrel Collab.) |
| AKHMETSHIN | 01B | PL B509 217 | R.R. Akhmetshin *et al.* | (Novosibirsk CMD-2 Collab.) |
| ALEXANDER | 01B | PR D64 092001 | J.P. Alexander *et al.* | (CLEO Collab.) |
| AKHMETSHIN | 00D | PL B489 125 | R.R. Akhmetshin *et al.* | (Novosibirsk CMD-2 Collab.) |
| AMELIN | 00 | NP A668 83 | D. Amelin *et al.* | (VES Collab.) |
| ANDERSON | 00A | PR D61 112002 | S. Anderson *et al.* | (CLEO Collab.) |
| EDWARDS | 00A | PR D61 072003 | K.W. Edwards *et al.* | (CLEO Collab.) |
| ABELE | 99C | PL B450 275 | A. Abele *et al.* | (Crystal Barrel Collab.) |
| ABELE | 99D | PL B468 178 | A. Abele *et al.* | (Crystal Barrel Collab.) |
| BERTIN | 98 | PR D57 55 | A. Bertin *et al.* | (OBELIX Collab.) |
| ABELE | 97 | PL B391 191 | A. Abele *et al.* | (Crystal Barrel Collab.) |
| ABELE | 97H | PL B415 280 | A. Abele *et al.* | (Crystal Barrel Collab.) |
| ACHASOV | 97 | PR D55 2663 | N.N. Achasov *et al.* | (NOVM) |
| BARATE | 97M | ZPHY C76 15 | R. Barate *et al.* | (ALEPH Collab.) |
| BERTIN | 97C | PL B408 476 | A. Bertin *et al.* | (OBELIX Collab.) |
| BERTIN | 97D | PL B414 220 | A. Bertin *et al.* | (OBELIX Collab.) |
| CLEGG | 94 | ZPHY C62 455 | A.B. Clegg, A. Donnachie | (LANC, MCHS) |
| BISELLO | 91B | NPBPS B21 111 | D. Bisello | (DM2 Collab.) |
| DOLINSKY | 91 | PRPL 202 99 | S.I. Dolinsky *et al.* | (NOVO) |
| DONNACHIE | 91 | ZPHY C51 689 | A. Donnachie, A.B. Clegg | (MCHS, LANC) |
| FUKUI | 91 | PL B257 241 | S. Fukui *et al.* | (SUGI, NAGO, KEK, KYOT+) |
| ARMSTRONG | 89E | PL B228 536 | T.A. Armstrong, M. Benayoun | (ATHU, BARI, BIRM+) |
| BISELLO | 89 | PL B220 321 | D. Bisello *et al.* | (DM2 Collab.) |
| DUBNICKA | 89 | JPG 15 1349 | S. Dubnicka *et al.* | (JINR, SLOV) |
| ANTONELLI | 88 | PL B212 133 | A. Antonelli *et al.* | (DM2 Collab.) |
| CLEGG | 88 | ZPHY C40 313 | A.B. Clegg, A. Donnachie | (MCHS, LANC) |
| DIEKMAN | 88 | PRPL 159 101 | B. Diekmann | (BONN) |
| FUKUI | 88 | PL B202 441 | S. Fukui *et al.* | (SUGI, NAGO, KEK, KYOT+) |
| ALBRECHT | 87L | PL B185 223 | H. Albrecht *et al.* | (ARGUS Collab.) |
| AULCHENKO | 87B | JETPL 45 145<br>Translated from ZETFP 45 118. | V.M. Aulchenko *et al.* | (NOVO) |
| BITYUKOV | 87 | PL B188 383 | S.I. Bityukov *et al.* | (SERP) |
| DONNACHIE | 87B | ZPHY C34 257 | A. Donnachie, A.B. Clegg | (MCHS, LANC) |
| DOLINSKY | 86 | PL B174 453 | S.I. Dolinsky *et al.* | (NOVO) |
| KURDADZE | 83 | JETPL 37 733<br>Translated from ZETFP 37 613. | L.M. Kurdadze *et al.* | (NOVO) |
| ASTON | 80C | PL 92B 211 | D. Aston | (BONN, CERN, EPOL, GLAS, LANC+) |
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