



$$I(J^P) = \frac{1}{2}(0^-)$$

## $D^0$ MASS

The fit includes  $D^\pm$ ,  $D^0$ ,  $D_S^\pm$ ,  $D^{*\pm}$ ,  $D^{*0}$ ,  $D_S^{*\pm}$ ,  $D_1(2420)^0$ ,  $D_2^*(2460)^0$ , and  $D_{S1}(2536)^\pm$  mass and mass difference measurements.

Given the recent addition of much more precise measurements, we have omitted all those masses published up through 1990. See any Review before 2015 for those earlier results.

| <u>VALUE (MeV)</u>       | <u>EVTS</u> | <u>DOCUMENT ID</u>        | <u>TECN</u> | <u>COMMENT</u>                     |
|--------------------------|-------------|---------------------------|-------------|------------------------------------|
| <b>1864.84 ± 0.05</b>    |             |                           |             | <b>OUR FIT</b>                     |
| <b>1864.84 ± 0.05</b>    |             |                           |             | <b>OUR AVERAGE</b>                 |
| 1864.845 ± 0.025 ± 0.057 | 63k         | <sup>1</sup> TOMARADZE 14 |             | $D^0 \rightarrow K^- 2\pi^+ \pi^-$ |
| 1864.75 ± 0.15 ± 0.11    |             | AAIJ 13V                  | LHCB        | $D^0 \rightarrow K^+ 2K^- \pi^+$   |
| 1864.841 ± 0.048 ± 0.063 | 4.3k        | <sup>2</sup> LEES         | 13S BABR    | $e^+ e^-$ at $\Upsilon(4S)$        |
| 1865.30 ± 0.33 ± 0.23    | 0.1k        | ANASHIN 10A               | KEDR        | $e^+ e^-$ at $\psi(3770)$          |
| 1864.847 ± 0.150 ± 0.095 | 0.3k        | CAWLFIELD 07              | CLEO        | $D^0 \rightarrow K_S^0 \phi$       |

<sup>1</sup> Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration. The largest source of error in the TOMARADZE 14 value is from the uncertainties in the  $K^-$  and  $K_S^0$  masses. The systematic error given above is the addition in quadrature of  $\pm 0.022 \pm 0.053$  MeV, where the second error is from those mass uncertainties.

<sup>2</sup> The largest source of error in the LEES 13S value is from the uncertainty of the  $K^+$  mass. The quoted systematic error is in fact  $\pm 0.043 + 3(m_{K^+} - 493.677)$ , in MeV.

## $m_{D^\pm} - m_{D^0}$

The fit includes  $D^\pm$ ,  $D^0$ ,  $D_S^\pm$ ,  $D^{*\pm}$ ,  $D^{*0}$ ,  $D_S^{*\pm}$ ,  $D_1(2420)^0$ ,  $D_2^*(2460)^0$ , and  $D_{S1}(2536)^\pm$  mass and mass difference measurements.

| <u>VALUE (MeV)</u>        | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                  |
|---------------------------|--------------------|-------------|---------------------------------|
| <b>4.77 ± 0.08</b>        |                    |             | <b>OUR FIT</b>                  |
| <b>4.76 ± 0.12 ± 0.07</b> |                    |             | <b>OUR AVERAGE</b>              |
|                           | AAIJ 13V           | LHCB        | $D^+ \rightarrow K^+ K^- \pi^+$ |

## $D^0$ MEAN LIFE

Measurements with an error  $> 10 \times 10^{-15}$  s have been omitted from the average.

| <u>VALUE (<math>10^{-15}</math> s)</u>   | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                        |
|--|-------------|--------------------|-------------|---------------------------------------|
| <b>410.1 ± 1.5</b>                       |             |                    |             | <b>OUR AVERAGE</b>                    |
| 409.6 ± 1.1 ± 1.5                        | 210k        | LINK 02F           | FOCS        | $\gamma$ nucleus, $\approx 180$ GeV   |
| 407.9 ± 6.0 ± 4.3                        | 10k         | KUSHNIR... 01      | SELX        | $K^- \pi^+$ , $K^- \pi^+ \pi^+ \pi^-$ |
| 413 ± 3 ± 4                              | 35k         | AITALA 99E         | E791        | $K^- \pi^+$                           |
| 408.5 ± 4.1 <sup>+</sup> <sub>-3.4</sub> | 25k         | BONVICINI 99       | CLE2        | $e^+ e^- \approx \Upsilon(4S)$        |
| 413 ± 4 ± 3                              | 16k         | FRABETTI 94D       | E687        | $K^- \pi^+$ , $K^- \pi^+ \pi^+ \pi^-$ |

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

|  |      |                     |     |      |                                    |
|--|------|---------------------|-----|------|------------------------------------|
| 424 ±11 ± 7  | 5118 | FRABETTI            | 91  | E687 | $K^- \pi^+, K^- \pi^+ \pi^+ \pi^-$ |
| 417 ±18 ±15  | 890  | ALVAREZ             | 90  | NA14 | $K^- \pi^+, K^- \pi^+ \pi^+ \pi^-$ |
| 388 $\begin{smallmatrix} +23 \\ -21 \end{smallmatrix}$ | 641  | <sup>1</sup> BARLAG | 90C | ACCM | $\pi^-$ Cu 230 GeV                 |
| 480 ±40 ±30  | 776  | ALBRECHT            | 88I | ARG  | $e^+ e^-$ 10 GeV                   |
| 422 ± 8 ±10  | 4212 | RAAB                | 88  | E691 | Photoproduction                    |
| 420 ±50  | 90   | BARLAG              | 87B | ACCM | $K^-$ and $\pi^-$ 200 GeV          |

<sup>1</sup> BARLAG 90C estimate systematic error to be negligible.

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$$|m_{D_1^0} - m_{D_2^0}| = x \Gamma$$

The  $D_1^0$  and  $D_2^0$  are the mass eigenstates of the  $D^0$  meson, as described in the note on “ $D^0$ - $\bar{D}^0$  Mixing,” above. The experiments usually present  $x \equiv \Delta m/\Gamma$ . Then  $\Delta m = x \Gamma = x \hbar/\tau$ .

“OUR EVALUATION” comes from CPV allowing averages provided by the Heavy Flavor Averaging Group, see the note on “ $D^0$ - $\bar{D}^0$  Mixing.”

| <u>VALUE (<math>10^{10} \hbar s^{-1}</math>)</u> | <u>CL%</u> | <u>DOCUMENT ID</u>         | <u>TECN</u> | <u>COMMENT</u>   |
|--|------------|----------------------------|-------------|--|
| <b><math>0.95^{+0.41}_{-0.44}</math></b>         |            |                            |             | <b>OUR EVALUATION</b>                                  |
| <b><math>1.0 \pm 0.5</math></b>                  |            |                            |             | <b>OUR AVERAGE</b> Error includes scale factor of 1.2. |
|  |            | <sup>1</sup> KO            | 14          | BELL $e^+ e^- \rightarrow \Upsilon(nS)$                |
| $1.37 \pm 0.46^{+0.18}_{-0.28}$                  |            | <sup>2</sup> PENG          | 14          | BELL $e^+ e^- \rightarrow \Upsilon(nS)$                |
|  |            | <sup>3</sup> AAIJ          | 13CE        | LHCB $p\bar{p}$ at 7, 8 TeV                            |
|  |            | <sup>4</sup> AALTONEN      | 13AE        | CDF $p\bar{p}$ at 1.96 TeV                             |
| $0.39 \pm 0.56 \pm 0.35$                         |            | <sup>5</sup> DEL-AMO-SA... | 10D         | BABR $e^+ e^-$ , 10.6 GeV                              |
|  |            | <sup>6</sup> AAIJ          | 13N         | LHCB Repl. by AAIJ 13CE                                |
| $6.4^{+1.4}_{-1.7} \pm 1.0$                      |            | <sup>7</sup> AUBERT        | 09AN        | BABR $e^+ e^-$ at 10.58 GeV                            |
| $-2^{+7}_{-6}$                                   |            | <sup>8</sup> LOWREY        | 09          | CLEO $e^+ e^-$ at $\psi(3770)$                         |
| $1.98 \pm 0.73^{+0.32}_{-0.41}$                  |            | <sup>9</sup> ZHANG         | 07B         | BELL Repl. by PENG 14                                  |
| < 7  | 95         | <sup>10</sup> ZHANG        | 06          | BELL $e^+ e^-$   |
| -11 to +22                                       |            | <sup>9</sup> ASNER         | 05          | CLEO $e^+ e^- \approx 10$ GeV                          |
| < 11   | 90         | BITENC                     | 05          | BELL   |
| < 30   | 90         | CAWLFIELD                  | 05          | CLEO   |
| < 7  | 95         | <sup>10</sup> LI           | 05A         | BELL See ZHANG 06                                      |
| < 22   | 95         | <sup>11</sup> LINK         | 05H         | FOCS $\gamma$ nucleus                                  |
| < 23   | 95         | AUBERT                     | 04Q         | BABR   |
| < 11   | 95         | <sup>10</sup> AUBERT       | 03Z         | BABR $e^+ e^-$ , 10.6 GeV                              |
| < 7  | 95         | <sup>12</sup> GODANG       | 00          | CLE2 $e^+ e^-$   |
| < 32   | 90         | <sup>13,14</sup> AITALA    | 98          | E791 $\pi^-$ nucleus, 500 GeV                          |
| < 24   | 90         | <sup>15</sup> AITALA       | 96C         | E791 $\pi^-$ nucleus, 500 GeV                          |
| < 21   | 90         | <sup>14,16</sup> ANJOS     | 88C         | E691 Photoproduction                                   |

- <sup>1</sup> Based on  $976 \text{ fb}^{-1}$  of data collected at  $Y(nS)$  resonances. Assumes no  $CP$  violation. Reported  $x'^2 = (0.09 \pm 0.22) \times 10^{-3}$  and  $y' = (4.6 \pm 3.4) \times 10^{-3}$ , where  $x' = x \cos(\delta) + y \sin(\delta)$ ,  $y' = y \cos(\delta) - x \sin(\delta)$  and  $\delta$  is the strong phase between  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .
- <sup>2</sup> The time-dependent Dalitz-plot analysis of  $D^0 \rightarrow K_S^0 \pi^+ \pi^-$  is employed. Decay-time information and interference on the Dalitz plot are used to distinguish doubly Cabibbo-suppressed decays from mixing and to measure the relative phase between  $D^0 \rightarrow K^{*+} \pi^-$  and  $\bar{D}^0 \rightarrow K^{*+} \pi^-$ . This value allows  $CP$  violation and is sensitive to the sign of  $\Delta m$ .
- <sup>3</sup> Based on  $3 \text{ fb}^{-1}$  of data collected at  $\sqrt{s} = 7, 8 \text{ TeV}$ . Assumes no  $CP$  violation. Reported  $x'^2 = (5.5 \pm 4.9) \times 10^{-4}$  and  $y' = (4.8 \pm 1.0) \times 10^{-3}$ , where  $x' = x \cos(\delta) + y \sin(\delta)$ ,  $y' = y \cos(\delta) - x \sin(\delta)$  and  $\delta$  is the strong phase between the  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .
- <sup>4</sup> Based on  $9.6 \text{ fb}^{-1}$  of data collected at the Tevatron. Assumes no  $CP$  violation. Reported  $x'^2 = (0.08 \pm 0.18) \times 10^{-3}$  and  $y' = (4.3 \pm 4.3) \times 10^{-3}$ , where  $x' = x \cos(\delta) + y \sin(\delta)$ ,  $y' = y \cos(\delta) - x \sin(\delta)$  and  $\delta$  is the strong phase between the  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .
- <sup>5</sup> DEL-AMO-SANCHEZ 10D uses  $540,800 \pm 800 K_S^0 \pi^+ \pi^-$  and  $79,900 \pm 300 K_S^0 K^+ K^-$  events in a time-dependent amplitude analysis of the  $D^0$  and  $\bar{D}^0$  Dalitz plots. No evidence was found for  $CP$  violation, and the values here assume no such violation.
- <sup>6</sup> Based on  $1 \text{ fb}^{-1}$  of data collected at  $\sqrt{s} = 7 \text{ TeV}$  in 2011. Assumes no  $CP$  violation. Reported  $x'^2 = (-0.9 \pm 1.3) \times 10^{-4}$  and  $y' = (7.2 \pm 2.4) \times 10^{-3}$ , where  $x' = x \cos(\delta) + y \sin(\delta)$ ,  $y' = y \cos(\delta) - x \sin(\delta)$  and  $\delta$  is the strong phase between the  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .
- <sup>7</sup> The AUBERT 09AN values are inferred from the branching ratio  $\Gamma(D^0 \rightarrow K^+ \pi^- \pi^0 \text{ via } \bar{D}^0) / \Gamma(D^0 \rightarrow K^- \pi^+ \pi^0)$  given near the end of this Listings. Mixing is distinguished from DCS decays using decay-time information. Interference between mixing and DCS is allowed. The phase between  $D^0 \rightarrow K^+ \pi^- \pi^0$  and  $\bar{D}^0 \rightarrow K^+ \pi^- \pi^0$  is assumed to be small. The width difference here is  $y''$ , which is not the same as  $y_{CP}$  in the note on  $D^0$ - $\bar{D}^0$  mixing.
- <sup>8</sup> LOWREY 09 uses quantum correlations in  $e^+ e^- \rightarrow D^0 \bar{D}^0$  at the  $\psi(3770)$ . See below for coherence factors and average relative strong phases for both  $D^0 \rightarrow K^- \pi^+ \pi^0$  and  $D^0 \rightarrow K^- \pi^- 2\pi^+$ . A fit that includes external measurements of charm mixing parameters gets  $\Delta m = (2.34 \pm 0.61) \times 10^{10} \text{ } \hbar \text{ s}^{-1}$ .
- <sup>9</sup> The ASNER 05 and ZHANG 07B values are from the time-dependent Dalitz-plot analysis of  $D^0 \rightarrow K_S^0 \pi^+ \pi^-$ . Decay-time information and interference on the Dalitz plot are used to distinguish doubly Cabibbo-suppressed decays from mixing and to measure the relative phase between  $D^0 \rightarrow K^{*+} \pi^-$  and  $\bar{D}^0 \rightarrow K^{*+} \pi^-$ . This value allows  $CP$  violation and is sensitive to the sign of  $\Delta m$ .
- <sup>10</sup> The AUBERT 03Z, LI 05A, and ZHANG 06 limits are inferred from the  $D^0$ - $\bar{D}^0$  mixing ratio  $\Gamma(K^+ \pi^- \text{ (via } \bar{D}^0)) / \Gamma(K^- \pi^+)$  given near the end of this  $D^0$  Listings. Decay-time information is used to distinguish DCS decays from  $D^0$ - $\bar{D}^0$  mixing. The limit allows interference between the DCS and mixing ratios, and also allows  $CP$  violation. AUBERT 03Z assumes the strong phase between  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$  amplitudes is small; if an arbitrary phase is allowed, the limit degrades by 20%. The LI 05A and ZHANG 06 limits are valid for an arbitrary strong phase.
- <sup>11</sup> This LINK 05H limit is inferred from the  $D^0$ - $\bar{D}^0$  mixing ratio  $\Gamma(K^+ \pi^- \text{ (via } \bar{D}^0)) / \Gamma(K^- \pi^+)$  given near the end of this  $D^0$  Listings. Decay-time information is used to distinguish DCS decays from  $D^0$ - $\bar{D}^0$  mixing. The limit allows interference between the DCS and mixing ratios, and also allows  $CP$  violation. The strong phase between

- $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$  is assumed to be small. If an arbitrary relative strong phase is allowed, the limit degrades by 25%.
- <sup>12</sup> This GODANG 00 limit is inferred from the  $D^0$ - $\bar{D}^0$  mixing ratio  $\Gamma(K^+ \pi^- \text{ via } \bar{D}^0) / \Gamma(K^- \pi^+)$  given near the end of this  $D^0$  Listings. Decay-time information is used to distinguish DCS decays from  $D^0$ - $\bar{D}^0$  mixing. The limit allows interference between the DCS and mixing ratios, and also allows  $CP$  violation. The strong phase between  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$  is assumed to be small. If an arbitrary relative strong phase is allowed, the limit degrades by a factor of two.
- <sup>13</sup> AITALA 98 allows interference between the doubly Cabibbo-suppressed and mixing amplitudes, and also allows  $CP$  violation in this term, but assumes that  $A_D = A_R = 0$ . See the note on " $D^0$ - $\bar{D}^0$  Mixing," above.
- <sup>14</sup> This limit is inferred from  $R_M$  for  $f = K^+ \pi^-$  and  $f = K^+ \pi^- \pi^+ \pi^-$ . See the note on " $D^0$ - $\bar{D}^0$  Mixing," above. Decay-time information is used to distinguish doubly Cabibbo-suppressed decays from  $D^0$ - $\bar{D}^0$  mixing.
- <sup>15</sup> This limit is inferred from  $R_M$  for  $f = K^+ \ell^- \bar{\nu}_\ell$ . See the note on " $D^0$ - $\bar{D}^0$  Mixing," above.
- <sup>16</sup> ANJOS 88C assumes that  $y = 0$ . See the note on " $D^0$ - $\bar{D}^0$  Mixing," above. Without this assumption, the limit degrades by about a factor of two.

$$(\Gamma_{D_1^0} - \Gamma_{D_2^0}) / \Gamma = 2y$$

The  $D_1^0$  and  $D_2^0$  are the mass eigenstates of the  $D^0$  meson, as described in the note on " $D^0$ - $\bar{D}^0$  Mixing," above.

Due to the strong phase difference between  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ , we exclude from the average those measurements of  $y'$  that are inferred from the  $D^0$ - $\bar{D}^0$  mixing ratio  $\Gamma(K^+ \pi^- \text{ via } \bar{D}^0) / \Gamma(K^+ \pi^-)$  given near the end of this  $D^0$  Listings.

Some early results have been omitted. See our 2006 *Review* (Journal of Physics **G33** 1 (2006)).

"OUR EVALUATION" comes from CPV allowing averages provided by the Heavy Flavor Averaging Group, see the note on " $D^0$ - $\bar{D}^0$  Mixing."

| VALUE (units $10^{-2}$ )                          | EVTS | DOCUMENT ID              | TECN | COMMENT  |
|---|------|--------------------------|------|--|
| <b>1.29<sup>+</sup><sub>-</sub> 0.14<br/>0.18</b> |      |                          |      | <b>OUR EVALUATION</b>                                  |
| <b>1.02<math>\pm</math> 0.25</b>                  |      |                          |      | <b>OUR AVERAGE</b> Error includes scale factor of 1.2. |
| 0.60 $\pm$ 0.30 <sup>+0.10<br/>-0.17</sup>        |      | <sup>1</sup> KO          | 14   | BELL $e^+ e^- \rightarrow \Upsilon(\text{nS})$         |
|   |      | <sup>2</sup> PENG        | 14   | BELL $e^+ e^- \rightarrow \Upsilon(\text{nS})$         |
|   |      | <sup>3</sup> AAIJ        | 13CE | LHCB $pp$ at 7, 8 TeV                                  |
|   |      | <sup>4</sup> AALTONEN    | 13AE | CDF $p\bar{p}$ at 1.96 TeV                             |
| 1.44 $\pm$ 0.36 $\pm$ 0.24                        |      | <sup>5</sup> LEES        | 13   | BABR $e^+ e^- \rightarrow \Upsilon(4S)$                |
| 0.55 $\pm$ 0.63 $\pm$ 0.41                        |      | <sup>6</sup> AAIJ        | 12K  | LHCB $pp$ at 7 TeV                                     |
| 1.14 $\pm$ 0.40 $\pm$ 0.30                        |      | <sup>7</sup> DEL-AMO-SA. | 10D  | BABR $e^+ e^-$ , 10.6 GeV                              |
| 0.22 $\pm$ 1.22 $\pm$ 1.04                        |      | <sup>8</sup> ZUPANC      | 09   | BELL $e^+ e^- \approx \Upsilon(4S)$                    |
| 2.62 $\pm$ 0.64 $\pm$ 0.50                        | 160k | <sup>9</sup> STARIC      | 07   | BELL $e^+ e^- \approx \Upsilon(4S)$                    |
| -1.0 $\pm$ 2.0 <sup>+1.4<br/>-1.6</sup>           | 18k  | <sup>10</sup> ABE        | 02I  | BELL $e^+ e^- \approx \Upsilon(4S)$                    |
| -2.4 $\pm$ 5.0 $\pm$ 2.8                          | 3393 | <sup>11</sup> CSORNA     | 02   | CLE2 $e^+ e^- \approx \Upsilon(4S)$                    |
| 6.84 $\pm$ 2.78 $\pm$ 1.48                        | 10k  | <sup>10</sup> LINK       | 00   | FOCS $\gamma$ nucleus                                  |
| +1.6 $\pm$ 5.8 $\pm$ 2.1                          |      | <sup>10</sup> AITALA     | 99E  | E791 $K^- \pi^+, K^+ K^-$                              |

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

|   |                 |              |           |                                    |
|---|-----------------|--------------|-----------|------------------------------------|
|   |                 | 12 AAIJ      | 13N LHCb  | Repl. by AAIJ 13CE                 |
| $2.32 \pm 0.44 \pm 0.36$  |                 | 13 AUBERT    | 09AI BABR | See LEES 13                        |
| $-0.12 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.10 \\ 1.28 \end{smallmatrix} \pm 0.68$  |                 | 14 AUBERT    | 09AN BABR | $e^+ e^-$ at 10.58 GeV             |
| $1.4 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 4.8 \\ 5.4 \end{smallmatrix}$   |                 | 15 LOWREY    | 09 CLEO   | $e^+ e^-$ at $\psi(3770)$          |
| $1.70 \pm 1.52$   | $12.7 \pm 0.3k$ | 16 AALTONEN  | 08E CDF   | $p\bar{p}$ , $\sqrt{s} = 1.96$ TeV |
| $2.06 \pm 0.66 \pm 0.38$  |                 | 17 AUBERT    | 08U BABR  | See AUBERT 09AI                    |
| $1.94 \pm 0.88 \pm 0.62$  | $4030 \pm 90$   | 16 AUBERT    | 07W BABR  | $e^+ e^- \approx 10.6$ GeV         |
| $0.74 \pm 0.50 \begin{smallmatrix} +0.20 \\ -0.31 \end{smallmatrix}$  | $534k$          | 18 ZHANG     | 07B BELL  | Repl. by PENG 14                   |
| $-0.7 \pm 4.9$  | $4k \pm 88$     | 16,19 ZHANG  | 06 BELL   | $e^+ e^-$                          |
| $-3.0 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 5.0 \\ 4.8 \end{smallmatrix} \begin{smallmatrix} +1.6 \\ -0.8 \end{smallmatrix}$ |                 | 18 ASNER     | 05 CLEO   | $e^+ e^- \approx 10$ GeV           |
| $-0.3 \pm 5.7$  |                 | 16,19 LI     | 05A BELL  | See ZHANG 06                       |
| $-5.2 \begin{smallmatrix} +18.4 \\ -16.8 \end{smallmatrix}$   |                 | 16,19 LINK   | 05H FOCS  | $\gamma$ nucleus                   |
| $1.6 \pm 0.8 \begin{smallmatrix} +1.0 \\ -0.8 \end{smallmatrix}$  | $450k$          | 20 AUBERT    | 03P BABR  | See AUBERT 08U                     |
| $1.6 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 6.2 \\ 12.8 \end{smallmatrix}$  |                 | 16,19 AUBERT | 03Z BABR  | $e^+ e^-$ , 10.6 GeV               |
| $-5.0 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 2.8 \\ 3.2 \end{smallmatrix} \pm 0.6$  |                 | 16 GODANG    | 00 CLE2   | $e^+ e^-$                          |

<sup>1</sup> Based on  $976 \text{ fb}^{-1}$  of data collected at  $Y(nS)$  resonances. Assumes no  $CP$  violation. Reported  $x'^2 = (0.09 \pm 0.22) \times 10^{-3}$  and  $y' = (4.6 \pm 3.4) \times 10^{-3}$ , where  $x' = x \cos(\delta) + y \sin(\delta)$ ,  $y' = y \cos(\delta) - x \sin(\delta)$  and  $\delta$  is the strong phase between  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .

<sup>2</sup> The time-dependent Dalitz-plot analysis of  $D^0 \rightarrow K_S^0 \pi^+ \pi^-$  is employed. Decay-time information and interference on the Dalitz plot are used to distinguish doubly Cabibbo-suppressed decays from mixing and to measure the relative phase between  $D^0 \rightarrow K^{*+} \pi^-$  and  $\bar{D}^0 \rightarrow K^{*+} \pi^-$ . This value allows  $CP$  violation and is sensitive to the sign of  $\Delta m$ .

<sup>3</sup> Based on  $3 \text{ fb}^{-1}$  of data collected at  $\sqrt{s} = 7, 8$  TeV. Assumes no  $CP$  violation. Reported  $x'^2 = (5.5 \pm 4.9) \times 10^{-4}$  and  $y' = (4.8 \pm 1.0) \times 10^{-3}$ , where  $x' = x \cos(\delta) + y \sin(\delta)$ ,  $y' = y \cos(\delta) - x \sin(\delta)$  and  $\delta$  is the strong phase between the  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .

<sup>4</sup> Based on  $9.6 \text{ fb}^{-1}$  of data collected at the Tevatron. Assumes no  $CP$  violation. Reported  $x'^2 = (0.08 \pm 0.18) \times 10^{-3}$  and  $y' = (4.3 \pm 4.3) \times 10^{-3}$ , where  $x' = x \cos(\delta) + y \sin(\delta)$ ,  $y' = y \cos(\delta) - x \sin(\delta)$  and  $\delta$  is the strong phase between the  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .

<sup>5</sup> Obtained  $y_{CP} = (0.72 \pm 0.18 \pm 0.12)\%$  based on three effective  $D^0$  lifetimes measured in  $K^\mp \pi^\pm$ ,  $K^- K^+$ , and  $\pi^- \pi^+$ . We list  $2y_{CP} = \Delta\Gamma/\Gamma$ .

<sup>6</sup> Compared the lifetimes of  $D^0$  decay to the  $CP$  eigenstate  $K^+ K^-$  with  $D^0$  decay to  $\pi^+ K^-$ . The values here assume no  $CP$  violation.

<sup>7</sup> DEL-AMO-SANCHEZ 10D uses  $540,800 \pm 800 K_S^0 \pi^+ \pi^-$  and  $79,900 \pm 300 K_S^0 K^+ K^-$  events in a time-dependent amplitude analyses of the  $D^0$  and  $\bar{D}^0$  Dalitz plots. No evidence was found for  $CP$  violation, and the values here assume no such violation.

<sup>8</sup> ZUPANC 09 uses a method based on measuring the mean decay time of  $D^0 \rightarrow K_S^0 K^+ K^-$  events for different  $K^+ K^-$  mass intervals.

<sup>9</sup> STARIC 07 compares the lifetimes of  $D^0$  decay to the  $CP$  eigenstates  $K^+ K^-$  and  $\pi^+ \pi^-$  with  $D^0$  decay to  $K^- \pi^+$ .

- <sup>10</sup> LINK 00, AITALA 99E, and ABE 02l measure the lifetime difference between  $D^0 \rightarrow K^- K^+$  ( $CP$  even) decays and  $D^0 \rightarrow K^- \pi^+$  ( $CP$  mixed) decays, or  $y_{CP} = [\Gamma(CP+) - \Gamma(CP-)] / [\Gamma(CP+) + \Gamma(CP-)]$ . We list  $2y_{CP} = \Delta\Gamma/\Gamma$ .
- <sup>11</sup> CSORNA 02 measures the lifetime difference between  $D^0 \rightarrow K^- K^+$  and  $\pi^- \pi^+$  ( $CP$  even) decays and  $D^0 \rightarrow K^- \pi^+$  ( $CP$  mixed) decays, or  $y_{CP} = [\Gamma(CP+) - \Gamma(CP-)] / [\Gamma(CP+) + \Gamma(CP-)]$ . We list  $2y_{CP} = \Delta\Gamma/\Gamma$ .
- <sup>12</sup> Based on  $1 \text{ fb}^{-1}$  of data collected at  $\sqrt{s} = 7 \text{ TeV}$  in 2011. Assumes no  $CP$  violation. Reported  $x'^2 = (-0.9 \pm 1.3) \times 10^{-4}$  and  $y' = (7.2 \pm 2.4) \times 10^{-3}$ , where  $x' = x \cos(\delta) + y \sin(\delta)$ ,  $y' = y \cos(\delta) - x \sin(\delta)$  and  $\delta$  is the strong phase between the  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .
- <sup>13</sup> This combines the  $y_{CP} = (\tau_{K\pi} / \tau_{KK}) - 1$  using untagged  $K^- \pi^+$  and  $K^- K^+$  events of AUBERT 09AI with the disjoint  $y_{CP}$  using tagged  $K^- \pi^+$ ,  $K^- K^+$ , and  $\pi^- \pi^+$  events of AUBERT 08U.
- <sup>14</sup> The AUBERT 09AN values are inferred from the branching ratio  $\Gamma(D^0 \rightarrow K^+ \pi^- \pi^0 \text{ via } \bar{D}^0) / \Gamma(D^0 \rightarrow K^- \pi^+ \pi^0)$  given near the end of this Listings. Mixing is distinguished from DCS decays using decay-time information. Interference between mixing and DCS is allowed. The phase between  $D^0 \rightarrow K^+ \pi^- \pi^0$  and  $\bar{D}^0 \rightarrow K^+ \pi^- \pi^0$  is assumed to be small. The width difference here is  $y''$ , which is not the same as  $y_{CP}$  in the note on  $D^0$ - $\bar{D}^0$  mixing.
- <sup>15</sup> LOWREY 09 uses quantum correlations in  $e^+ e^- \rightarrow D^0 \bar{D}^0$  at the  $\psi(3770)$ . See below for coherence factors and average relative strong phases for both  $D^0 \rightarrow K^- \pi^+ \pi^0$  and  $D^0 \rightarrow K^- \pi^- 2\pi^+$ . A fit that includes external measurements of charm mixing parameters gets  $2y = (1.62 \pm 0.32) \times 10^{-2}$ .
- <sup>16</sup> The GODANG 00, AUBERT 03Z, LINK 05H, LI 05A, ZHANG 06, AUBERT 07W, and AALTONEN 08E limits are inferred from the  $D^0$ - $\bar{D}^0$  mixing ratio  $\Gamma(K^+ \pi^- \text{ (via } \bar{D}^0)) / \Gamma(K^- \pi^+)$  given near the end of this  $D^0$  Listings. Decay-time information is used to distinguish DCS decays from  $D^0$ - $\bar{D}^0$  mixing. The limits allow interference between the DCS and mixing ratios, and all except AUBERT 07W and AALTONEN 08E also allow  $CP$  violation. The phase between  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$  is assumed to be small. This is a measurement of  $y'$  and is not the same as the  $y_{CP}$  of our note above on " $D^0$ - $\bar{D}^0$  Mixing."
- <sup>17</sup> This value combines the results of AUBERT 08U and AUBERT 03P.
- <sup>18</sup> The ASNER 05 and ZHANG 07B values are from the time-dependent Dalitz-plot analysis of  $D^0 \rightarrow K_S^0 \pi^+ \pi^-$ . Decay-time information and interference on the Dalitz plot are used to distinguish doubly Cabibbo-suppressed decays from mixing and to measure the relative phase between  $D^0 \rightarrow K^{*+} \pi^-$  and  $\bar{D}^0 \rightarrow K^{*+} \pi^-$ . This limit allows  $CP$  violation.
- <sup>19</sup> The ranges of AUBERT 03Z, LINK 05H, LI 05A, and ZHANG 06 measurements are for 95% confidence level.
- <sup>20</sup> AUBERT 03P measures  $Y \equiv 2 \tau^0 / (\tau^+ + \tau^-) - 1$ , where  $\tau^0$  is the  $D^0 \rightarrow K^- \pi^+$  (and  $\bar{D}^0 \rightarrow K^+ \pi^-$ ) lifetime, and  $\tau^+$  and  $\tau^-$  are the  $D^0$  and  $\bar{D}^0$  lifetimes to  $CP$ -even states (here  $K^- K^+$  and  $\pi^- \pi^+$ ). In the limit of  $CP$  conservation,  $Y = y \equiv \Delta\Gamma / 2\Gamma$  (we list  $2y = \Delta\Gamma/\Gamma$ ). AUBERT 03P also uses  $\tau^+ - \tau^-$  to get  $\Delta Y = -0.008 \pm 0.006 \pm 0.002$ .

## |q/p|

The mass eigenstates  $D_1^0$  and  $D_2^0$  are related to the  $C = \pm 1$  states by  $|D_{1,2}^0\rangle = p|D^0\rangle + q|\bar{D}^0\rangle$ . See the note on " $D^0$ - $\bar{D}^0$  Mixing" above.

“OUR EVALUATION” comes from CPV allowing averages provided by the Heavy Flavor Averaging Group. This would include as-yet-unpublished results, see the note on “ $D^0$ - $\bar{D}^0$  Mixing.”

| VALUE   | DOCUMENT ID  | TECN      | COMMENT                         |
|---|--|-----------|---------------------------------|
| <b><math>0.92^{+0.12}_{-0.09}</math> OUR EVALUATION</b>                       | HFAG fit; see the note on “ $D^0$ - $\bar{D}^0$ Mixing.” |           |                                 |
| <b><math>0.90^{+0.16+0.08}_{-0.15-0.06}</math></b>                            | 1 PENG   | 14 BELL   | $e^+e^- \rightarrow \gamma(nS)$ |
|   | 2 AAIJ   | 13CE LHCB | $pp$ at 7, 8 TeV                |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |  |           |                                 |
| $0.86^{+0.30+0.10}_{-0.29-0.08}$  | <sup>3</sup> ZHANG                                       | 07B BELL  | Repl. by PENG 14                |

<sup>1</sup> The time-dependent Dalitz-plot analysis of  $D^0 \rightarrow K_S^0 \pi^+ \pi^-$  is employed. Decay-time information and interference on the Dalitz plot are used to distinguish doubly Cabibbo-suppressed decays from mixing and to measure the relative phase between  $D^0 \rightarrow K^{*+} \pi^-$  and  $\bar{D}^0 \rightarrow K^{*+} \pi^-$ . This value allows  $CP$  violation and is sensitive to the sign of  $\Delta m$ .

<sup>2</sup> Based on  $3 \text{ fb}^{-1}$  of data collected at  $\sqrt{s} = 7, 8 \text{ TeV}$ . Allowing for  $CP$  violation, the direct  $CP$  violation in mixing is reported  $0.75 < |q/p| < 1.24$  at the 68.3% CL for the  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .

<sup>3</sup> The phase of  $p/q$  is  $(-14^{+16}_{-18} \pm 5)^\circ$ . The ZHANG 07B value is from the time-dependent Dalitz-plot analysis of  $D^0 \rightarrow K_S^0 \pi^+ \pi^-$ . Decay-time information and interference on the Dalitz plot are used to distinguish doubly Cabibbo-suppressed decays from mixing and to measure the relative phase between  $D^0 \rightarrow K^{*+} \pi^-$  and  $\bar{D}^0 \rightarrow K^{*+} \pi^-$ . This value allows  $CP$  violation.

## $A_\Gamma$

$A_\Gamma$  is the decay-rate asymmetry for  $CP$ -even final states  $A_\Gamma = (\bar{\tau}_+ - \tau_+) / (\bar{\tau}_+ + \tau_+)$ .

See the note on “ $D^0$ - $\bar{D}^0$  Mixing” above.

| VALUE (units $10^{-3}$ )  | EVTS | DOCUMENT ID           | TECN      | COMMENT                                    |
|---|------|-----------------------|-----------|--|
| <b><math>-0.125 \pm 0.526</math> OUR EVALUATION</b>                           |      |                       |           |  |
| <b><math>-0.3 \pm 0.5</math> OUR AVERAGE</b>                                  |      |                       |           |  |
| $-0.35 \pm 0.62 \pm 0.12$   |      | 1 AAIJ                | 14AL LHCB | $pp$ at 7 TeV                              |
| $0.33 \pm 1.06 \pm 0.14$  |      | 2 AAIJ                | 14AL LHCB | $pp$ at 7 TeV                              |
| $-1.2 \pm 1.2$  | 1.8M | <sup>3</sup> AALTONEN | 14Q CDF   | $p\bar{p}$ , $\sqrt{s} = 1.96 \text{ TeV}$ |
| $0.9 \pm 2.6 \pm 0.6$   | 0.7M | LEES                  | 13 BABR   | $e^+e^- \rightarrow \gamma(4S)$            |
| $-5.9 \pm 5.9 \pm 2.1$  |      | 1 AAIJ                | 12K LHCB  | $pp$ at 7 TeV                              |
| $0.1 \pm 3.0 \pm 2.5$   |      | STARIC                | 07 BELL   | $e^+e^- \approx \gamma(4S)$                |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |      |                       |           |  |
| $2.6 \pm 3.6 \pm 0.8$   |      | AUBERT                | 08U BABR  | See LEES 13                                |
| $8 \pm 6 \pm 2$   |      | AUBERT                | 03P BABR  | $e^+e^- \approx \gamma(4S)$                |

<sup>1</sup> Measured using  $D^0 \rightarrow K^+ K^-$  decays.

<sup>2</sup> Measured using  $D^0 \rightarrow \pi^+ \pi^-$  decays.

<sup>3</sup> Combined results from  $D^0 \rightarrow K^+ K^-$  and  $D^0 \rightarrow \pi^+ \pi^-$  decays.

### cos $\delta$

$\delta$  is the  $D^0 \rightarrow K^+ \pi^-$  relative strong phase.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

#### 0.97 ± 0.11 OUR AVERAGE

|                    |                      |     |   |
|--------------------|----------------------|-----|---|
| 1.02 ± 0.11 ± 0.06 | <sup>1</sup> ABLIKIM | 14C | BES3 $e^+ e^- \rightarrow D^0 \bar{D}^0$ , 3.77 GeV |
|--------------------|----------------------|-----|---|

|  |                    |    |   |
|--|--------------------|----|---|
| 0.81 <sup>+0.22+0.07</sup> <sub>-0.18-0.05</sub> | <sup>2</sup> ASNER | 12 | CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$ , 3.77 GeV |
|--|--------------------|----|---|

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

|   |                    |    |                        |
|---|--------------------|----|------------------------|
| 1.03 <sup>+0.31</sup> <sub>-0.17</sub> ± 0.06 | <sup>3</sup> ASNER | 08 | CLEO Repl. by ASNER 12 |
|---|--------------------|----|------------------------|

<sup>1</sup> Uses quantum correlations in  $e^+ e^- \rightarrow D^0 \bar{D}^0$  at the  $\psi(3770)$  to measure the asymmetry of the branching fraction of  $D^0 \rightarrow K^+ \pi^-$  in  $CP$ -odd and  $CP$ -even eigenstates to be  $(12.7 \pm 1.3 \pm 0.7)\%$ . A fit that includes external measurements of charm mixing parameters finds the value quoted above.

<sup>2</sup> Uses quantum correlations in  $e^+ e^- \rightarrow D^0 \bar{D}^0$  at the  $\psi(3770)$ , where decay rates of  $CP$ -tagged  $K\pi$  final states depend on the strong phases between the decays of  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ . The measurements obtained  $\sin(\delta) = -0.01 \pm 0.41 \pm 0.04$  and  $|\delta| = (10^{+28+13}_{-53-00})^\circ$  as well. A fit that includes external measurements of charm mixing parameters finds  $\cos(\delta) = 1.15^{+0.19+0.00}_{-0.17-0.08}$ ,  $\sin(\delta) = 0.56^{+0.32+0.21}_{-0.31-0.20}$ , and  $|\delta| = (18^{+11}_{-17})^\circ$ .

<sup>3</sup> ASNER 08 uses quantum correlations in  $e^+ e^- \rightarrow D^0 \bar{D}^0$  at the  $\psi(3770)$ , where decay rates of  $CP$ -tagged  $K\pi$  final states depend on  $\cos \delta$  because of interfering amplitudes. The above measurement implies  $|\delta| < 75^\circ$  with a confidence level of 95%. A fit that includes external measurements of charm mixing parameters finds  $\cos \delta = 1.10 \pm 0.35 \pm 0.07$ . See also the note on “ $D^0 - \bar{D}^0$  Mixing” p. 783 in our 2008 Review (PDG 08).

### $D^0 \rightarrow K^- \pi^+ \pi^0$ COHERENCE FACTOR $R_{K\pi\pi^0}$

See the note on ‘ $D^0 - \bar{D}^0$  Mixing’ for the definition.  $R_{K\pi\pi^0}$  can have any value between 0 and 1. A value near 1 indicates the decay is dominated by a few intermediate states with limited interference.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

|                    |                    |    |  |
|--------------------|--------------------|----|--|
| <b>0.82 ± 0.07</b> | <sup>1</sup> LIBBY | 14 | CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$ at $\psi(3770)$ |
|--------------------|--------------------|----|--|

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

|  |                     |    |                        |
|--|---------------------|----|------------------------|
| 0.78 <sup>+0.11</sup> <sub>-0.25</sub> | <sup>2</sup> LOWREY | 09 | CLEO Repl. by LIBBY 14 |
|--|---------------------|----|------------------------|

<sup>1</sup> Uses quantum correlations in  $e^+ e^- \rightarrow D^0 \bar{D}^0$  at the  $\psi(3770)$ , where the decay rates of  $CP$ -tagged  $K^- \pi^+ \pi^0$  final states depend on  $R_{K\pi\pi^0}$  and  $\delta^{K\pi\pi^0}$ .

<sup>2</sup> LOWREY 09 uses quantum correlations in  $e^+ e^- \rightarrow D^0 \bar{D}^0$  at the  $\psi(3770)$ , where the decay rates of  $CP$ -tagged  $K^- \pi^+ \pi^0$  final states depend on  $R_{K\pi\pi^0}$  and  $\delta^{K\pi\pi^0}$ . A fit that includes external measurements of charm mixing parameters gets  $R_{K\pi\pi^0} = 0.84 \pm 0.07$ .

### $D^0 \rightarrow K^- \pi^+ \pi^0$ AVERAGE RELATIVE STRONG PHASE $\delta^{K\pi\pi^0}$

The quoted value of  $\delta$  is based on the same sign  $CP$  phase of  $D^0$  and  $\bar{D}^0$  convention.

| VALUE (°) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

|  |                    |    |  |
|--|--------------------|----|--|
| <b>164<sup>+20</sup><sub>-14</sub></b> | <sup>1</sup> LIBBY | 14 | CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$ at $\psi(3770)$ |
|--|--------------------|----|--|

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

|                                   |                     |    |                        |
|-----------------------------------|---------------------|----|------------------------|
| 239 <sup>+32</sup> <sub>-28</sub> | <sup>2</sup> LOWREY | 09 | CLEO Repl. by LIBBY 14 |
|-----------------------------------|---------------------|----|------------------------|



<sup>1</sup> Uses quantum correlations in  $e^+e^- \rightarrow D^0\bar{D}^0$  at the  $\psi(3770)$ , where the decay rates of  $CP$ -tagged  $K^-\pi^+\pi^0$  final states depend on  $R_{K\pi\pi^0}$  and  $\delta^{K\pi\pi^0}$ .

<sup>2</sup> LOWREY 09 uses quantum correlations in  $e^+e^- \rightarrow D^0\bar{D}^0$  at the  $\psi(3770)$ , where the decay rates of  $CP$ -tagged  $K^-\pi^+\pi^0$  final states depend on  $R_{K\pi\pi^0}$  and  $\delta^{K\pi\pi^0}$ .

A fit that includes external measurements of charm mixing parameters gets  $\delta^{K\pi\pi^0} = (227^{+14}_{-17})^\circ$ .

### $D^0 \rightarrow K^-\pi^-2\pi^+$ COHERENCE FACTOR $R_{K3\pi}$

See the note on ' $D^0$ - $\bar{D}^0$  Mixing' for the definition.  $R_{K3\pi}$  can have any value between 0 and 1. A value near 1 indicates the decay is dominated by a few intermediate states with limited interference.

| VALUE                  | DOCUMENT ID        | TECN | COMMENT  |
|------------------------|--------------------|------|--|
| $0.32^{+0.20}_{-0.28}$ | <sup>1</sup> LIBBY | 14   | CLEO $e^+e^- \rightarrow D^0\bar{D}^0$ at $\psi(3770)$ |

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

|                        |                     |    |                        |
|------------------------|---------------------|----|------------------------|
| $0.36^{+0.24}_{-0.30}$ | <sup>2</sup> LOWREY | 09 | CLEO Repl. by LIBBY 14 |
|------------------------|---------------------|----|------------------------|

<sup>1</sup> Uses quantum correlations in  $e^+e^- \rightarrow D^0\bar{D}^0$  at the  $\psi(3770)$ , where the decay rates of  $CP$ -tagged  $K^-\pi^-2\pi^+$  final states depend on  $R_{K3\pi}$  and  $\delta^{K3\pi}$ .

<sup>2</sup> LOWREY 09 uses quantum correlations in  $e^+e^- \rightarrow D^0\bar{D}^0$  at the  $\psi(3770)$ , where the decay rates of  $CP$ -tagged  $K^-\pi^-2\pi^+$  final states depend on  $R_{K3\pi}$  and  $\delta^{K3\pi}$ .

A fit that includes external measurements of charm mixing parameters gets  $R_{K3\pi} = 0.33^{+0.26}_{-0.23}$ .

### $D^0 \rightarrow K^-\pi^-2\pi^+$ AVERAGE RELATIVE STRONG PHASE $\delta^{K3\pi}$

The quoted value of  $\delta$  is based on the same sign  $CP$  phase of  $D^0$  and  $\bar{D}^0$  convention.

| VALUE ( $^\circ$ ) | DOCUMENT ID        | TECN | COMMENT  |
|--------------------|--------------------|------|--|
| $225^{+21}_{-78}$  | <sup>1</sup> LIBBY | 14   | CLEO $e^+e^- \rightarrow D^0\bar{D}^0$ at $\psi(3770)$ |

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

|                   |                     |    |                        |
|-------------------|---------------------|----|------------------------|
| $118^{+62}_{-53}$ | <sup>2</sup> LOWREY | 09 | CLEO Repl. by LIBBY 14 |
|-------------------|---------------------|----|------------------------|

<sup>1</sup> Uses quantum correlations in  $e^+e^- \rightarrow D^0\bar{D}^0$  at the  $\psi(3770)$ , where the decay rates of  $CP$ -tagged  $K^-\pi^-2\pi^+$  final states depend on  $R_{K3\pi}$  and  $\delta^{K3\pi}$ .

<sup>2</sup> LOWREY 09 uses quantum correlations in  $e^+e^- \rightarrow D^0\bar{D}^0$  at the  $\psi(3770)$ , where the decay rates of  $CP$ -tagged  $K^-\pi^-2\pi^+$  final states depend on  $R_{K3\pi}$  and  $\delta^{K3\pi}$ .

A fit that includes external measurements of charm mixing parameters gets  $\delta^{K3\pi} = (114^{+26}_{-23})^\circ$ .

### $D^0 \rightarrow K_S^0 K^+\pi^-$ COHERENCE FACTOR $R_{K_S^0 K\pi}$

| VALUE           | DOCUMENT ID         | TECN | COMMENT  |
|-----------------|---------------------|------|--|
| $0.73 \pm 0.08$ | <sup>1</sup> INSLER | 12   | CLEO $e^+e^- \rightarrow D^0\bar{D}^0$ at 3.77 GeV |

<sup>1</sup> Uses quantum correlations in  $e^+e^- \rightarrow D^0\bar{D}^0$  at the  $\psi(3770)$ , where the signal side  $D$  decays to  $K_S^0 K\pi$  and the tag-side  $D$  decays to  $K\pi$ ,  $K\pi\pi\pi$ ,  $K\pi\pi^0$ .

### $D^0 \rightarrow K_S^0 K^+ \pi^-$ AVERAGE RELATIVE STRONG PHASE $\delta^{K_S^0 K \pi}$

The quoted value of  $\delta$  is based on the same sign  $CP$  phase of  $D^0$  and  $\bar{D}^0$  convention.

| VALUE (°)  | DOCUMENT ID         | TECN | COMMENT  |
|--|---------------------|------|--|
| <b><math>8.3 \pm 15.2</math></b>   | <sup>1</sup> INSLER | 12   | CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$ at 3.77 GeV |
| <sup>1</sup> Uses quantum correlations in $e^+ e^- \rightarrow D^0 \bar{D}^0$ at the $\psi(3770)$ , where the signal side $D$ decays to $K_S^0 K \pi$ and the tag-side $D$ decays to $K \pi, K \pi \pi \pi, K \pi \pi^0$ . |                     |      |  |

### $D^0 \rightarrow K^* K$ COHERENCE FACTOR $R_{K^* K}$

| VALUE  | DOCUMENT ID         | TECN | COMMENT  |
|--|---------------------|------|--|
| <b><math>1.00 \pm 0.16</math></b>  | <sup>1</sup> INSLER | 12   | CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$ at 3.77 GeV |
| <sup>1</sup> Uses quantum correlations in $e^+ e^- \rightarrow D^0 \bar{D}^0$ at the $\psi(3770)$ , where the signal side $D$ decays to $K_S^0 K \pi$ and the tag-side $D$ decays to $K \pi, K \pi \pi \pi, K \pi \pi^0$ . |                     |      |  |

### $D^0 \rightarrow K^* K$ AVERAGE RELATIVE STRONG PHASE $\delta^{K^* K}$

The quoted value of  $\delta$  is based on the same sign  $CP$  phase of  $D^0$  and  $\bar{D}^0$  convention.

| VALUE (°)  | DOCUMENT ID         | TECN | COMMENT  |
|--|---------------------|------|--|
| <b><math>26.5 \pm 15.8</math></b>  | <sup>1</sup> INSLER | 12   | CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$ at 3.77 GeV |
| <sup>1</sup> Uses quantum correlations in $e^+ e^- \rightarrow D^0 \bar{D}^0$ at the $\psi(3770)$ , where the signal side $D$ decays to $K_S^0 K \pi$ and the tag-side $D$ decays to $K \pi, K \pi \pi \pi, K \pi \pi^0$ . |                     |      |  |

### $CP$ -EVEN FRACTION in $D^0 \rightarrow \pi^+ \pi^- \pi^0$ DECAYS

The  $CP$ -even fraction  $F_+$ , defined for self-conjugate final states, like the coherence factor is useful for measuring the unitary triangle angle  $\gamma$  in  $B \rightarrow DK$  decays. A purely  $CP$ -even state has  $F_+ = 1$ , a  $CP$ -odd one has  $F_+ = 0$ . For details, see NAYAK 15.

| VALUE (%)                                | DOCUMENT ID | TECN | COMMENT                        |
|--|-------------|------|--------------------------------|
| <b><math>96.8 \pm 1.7 \pm 0.6</math></b> | NAYAK       | 15   | CLEO $e^+ e^-$ at $\psi(3770)$ |

### $CP$ -EVEN FRACTION in $D^0 \rightarrow K^+ K^- \pi^0$ DECAYS

The  $CP$ -even fraction  $F_+$ , defined for self-conjugate final states, like the coherence factor is useful for measuring the unitary triangle angle  $\gamma$  in  $B \rightarrow DK$  decays. A purely  $CP$ -even state has  $F_+ = 1$ , a  $CP$ -odd one has  $F_+ = 0$ . For details, see NAYAK 15.

| VALUE (%)                                | DOCUMENT ID | TECN | COMMENT                        |
|--|-------------|------|--------------------------------|
| <b><math>73.1 \pm 5.8 \pm 2.1</math></b> | NAYAK       | 15   | CLEO $e^+ e^-$ at $\psi(3770)$ |

## $D^0$ DECAY MODES

Most decay modes (other than the semileptonic modes) that involve a neutral  $K$  meson are now given as  $K_S^0$  modes, not as  $\bar{K}^0$  modes. Nearly always it is a  $K_S^0$  that is measured, and interference between Cabibbo-allowed and doubly Cabibbo-suppressed modes can invalidate the assumption that  $2\Gamma(K_S^0) = \Gamma(\bar{K}^0)$ .

| Mode   | Fraction ( $\Gamma_i/\Gamma$ )                               | Scale factor/<br>Confidence level |
|--|--|-----------------------------------|
| <b>Topological modes</b>   |  |                                   |
| $\Gamma_1$ 0-prongs  | [a] (15 ± 6 ) %  |                                   |
| $\Gamma_2$ 2-prongs  | (70 ± 6 ) %  |                                   |
| $\Gamma_3$ 4-prongs  | [b] (14.5 ± 0.5 ) %  |                                   |
| $\Gamma_4$ 6-prongs  | [c] ( 6.4 ± 1.3 ) × 10 <sup>-4</sup>                         |                                   |
| <b>Inclusive modes</b>   |  |                                   |
| $\Gamma_5$ e <sup>+</sup> anything   | [d] ( 6.49 ± 0.11 ) %  |                                   |
| $\Gamma_6$ μ <sup>+</sup> anything   | ( 6.7 ± 0.6 ) %  |                                   |
| $\Gamma_7$ K <sup>-</sup> anything   | (54.7 ± 2.8 ) %  | S=1.3                             |
| $\Gamma_8$ $\bar{K}^0$ anything + K <sup>0</sup> anything                                | (47 ± 4 ) %  |                                   |
| $\Gamma_9$ K <sup>+</sup> anything   | ( 3.4 ± 0.4 ) %  |                                   |
| $\Gamma_{10}$ K*(892) <sup>-</sup> anything  | (15 ± 9 ) %  |                                   |
| $\Gamma_{11}$ $\bar{K}^*(892)^0$ anything  | ( 9 ± 4 ) %  |                                   |
| $\Gamma_{12}$ K*(892) <sup>+</sup> anything  | < 3.6 %  | CL=90%                            |
| $\Gamma_{13}$ K*(892) <sup>0</sup> anything  | ( 2.8 ± 1.3 ) %  |                                   |
| $\Gamma_{14}$ η anything   | ( 9.5 ± 0.9 ) %  |                                   |
| $\Gamma_{15}$ η' anything  | ( 2.48 ± 0.27 ) %  |                                   |
| $\Gamma_{16}$ φ anything   | ( 1.05 ± 0.11 ) %  |                                   |
| <b>Semileptonic modes</b>  |  |                                   |
| $\Gamma_{17}$ K <sup>-</sup> ℓ <sup>+</sup> ν <sub>ℓ</sub>                               |  |                                   |
| $\Gamma_{18}$ K <sup>-</sup> e <sup>+</sup> ν <sub>e</sub>                               | ( 3.57 ± 0.06 ) %  | S=1.5                             |
| $\Gamma_{19}$ K <sup>-</sup> μ <sup>+</sup> ν <sub>μ</sub>                               | ( 3.33 ± 0.13 ) %  |                                   |
| $\Gamma_{20}$ K*(892) <sup>-</sup> e <sup>+</sup> ν <sub>e</sub>                         | ( 2.16 ± 0.16 ) %  |                                   |
| $\Gamma_{21}$ K*(892) <sup>-</sup> μ <sup>+</sup> ν <sub>μ</sub>                         | ( 1.92 ± 0.25 ) %  |                                   |
| $\Gamma_{22}$ K <sup>-</sup> π <sup>0</sup> e <sup>+</sup> ν <sub>e</sub>                | ( 1.6 <sup>+1.3</sup> / <sub>-0.5</sub> ) %                  |                                   |
| $\Gamma_{23}$ $\bar{K}^0$ π <sup>-</sup> e <sup>+</sup> ν <sub>e</sub>                   | ( 2.7 <sup>+0.9</sup> / <sub>-0.7</sub> ) %                  |                                   |
| $\Gamma_{24}$ K <sup>-</sup> π <sup>+</sup> π <sup>-</sup> e <sup>+</sup> ν <sub>e</sub> | ( 2.8 <sup>+1.4</sup> / <sub>-1.1</sub> ) × 10 <sup>-4</sup> |                                   |
| $\Gamma_{25}$ K <sub>1</sub> (1270) <sup>-</sup> e <sup>+</sup> ν <sub>e</sub>           | ( 7.6 <sup>+4.0</sup> / <sub>-3.1</sub> ) × 10 <sup>-4</sup> |                                   |
| $\Gamma_{26}$ K <sup>-</sup> π <sup>+</sup> π <sup>-</sup> μ <sup>+</sup> ν <sub>μ</sub> | < 1.2 × 10 <sup>-3</sup>                                     | CL=90%                            |

|               |                                     |                   |                  |        |
|---------------|-------------------------------------|-------------------|------------------|--------|
| $\Gamma_{27}$ | $(\bar{K}^*(892)\pi)^-\mu^+\nu_\mu$ | $< 1.4$           | $\times 10^{-3}$ | CL=90% |
| $\Gamma_{28}$ | $\pi^-e^+\nu_e$                     | $(2.89 \pm 0.08)$ | $\times 10^{-3}$ |        |
| $\Gamma_{29}$ | $\pi^-\mu^+\nu_\mu$                 | $(2.38 \pm 0.24)$ | $\times 10^{-3}$ |        |
| $\Gamma_{30}$ | $\rho^-e^+\nu_e$                    | $(1.77 \pm 0.16)$ | $\times 10^{-3}$ |        |

**Hadronic modes with one  $\bar{K}$**

|               |   |                                 |                  |        |
|---------------|---|---------------------------------|------------------|--------|
| $\Gamma_{31}$ | $K^-\pi^+$  | $(3.93 \pm 0.04)$               | %                | S=1.1  |
| $\Gamma_{32}$ | $K^+\pi^-$  | $(1.399 \pm 0.027)$             | $\times 10^{-4}$ |        |
| $\Gamma_{33}$ | $K_S^0\pi^0$  | $(1.20 \pm 0.04)$               | %                |        |
| $\Gamma_{34}$ | $K_L^0\pi^0$  | $(10.0 \pm 0.7)$                | $\times 10^{-3}$ |        |
| $\Gamma_{35}$ | $K_S^0\pi^+\pi^-$   | [e] $(2.85 \pm 0.20)$           | %                | S=1.1  |
| $\Gamma_{36}$ | $K_S^0\rho^0$   | $(6.4 \pm_{-0.8}^{0.7})$        | $\times 10^{-3}$ |        |
| $\Gamma_{37}$ | $K_S^0\omega, \omega \rightarrow \pi^+\pi^-$                    | $(2.1 \pm 0.6)$                 | $\times 10^{-4}$ |        |
| $\Gamma_{38}$ | $K_S^0(\pi^+\pi^-)_{S\text{-wave}}$                             | $(3.4 \pm 0.8)$                 | $\times 10^{-3}$ |        |
| $\Gamma_{39}$ | $K_S^0f_0(980),$<br>$f_0(980) \rightarrow \pi^+\pi^-$           | $(1.23 \pm_{-0.24}^{0.40})$     | $\times 10^{-3}$ |        |
| $\Gamma_{40}$ | $K_S^0f_0(1370),$<br>$f_0(1370) \rightarrow \pi^+\pi^-$         | $(2.8 \pm_{-1.3}^{0.9})$        | $\times 10^{-3}$ |        |
| $\Gamma_{41}$ | $K_S^0f_2(1270),$<br>$f_2(1270) \rightarrow \pi^+\pi^-$         | $(9 \pm_{-6}^{10})$             | $\times 10^{-5}$ |        |
| $\Gamma_{42}$ | $K^*(892)^-\pi^+,$<br>$K^*(892)^- \rightarrow K_S^0\pi^-$       | $(1.68 \pm_{-0.18}^{0.15})$     | %                |        |
| $\Gamma_{43}$ | $K_0^*(1430)^-\pi^+,$<br>$K_0^*(1430)^- \rightarrow K_S^0\pi^-$ | $(2.73 \pm_{-0.34}^{0.40})$     | $\times 10^{-3}$ |        |
| $\Gamma_{44}$ | $K_2^*(1430)^-\pi^+,$<br>$K_2^*(1430)^- \rightarrow K_S^0\pi^-$ | $(3.4 \pm_{-1.0}^{1.9})$        | $\times 10^{-4}$ |        |
| $\Gamma_{45}$ | $K^*(1680)^-\pi^+,$<br>$K^*(1680)^- \rightarrow K_S^0\pi^-$     | $(4 \pm 4)$                     | $\times 10^{-4}$ |        |
| $\Gamma_{46}$ | $K^*(892)^+\pi^-,$<br>$K^*(892)^+ \rightarrow K_S^0\pi^+$       | [f] $(1.15 \pm_{-0.34}^{0.60})$ | $\times 10^{-4}$ |        |
| $\Gamma_{47}$ | $K_0^*(1430)^+\pi^-,$<br>$K_0^*(1430)^+ \rightarrow K_S^0\pi^+$ | [f] $< 1.4$                     | $\times 10^{-5}$ | CL=95% |
| $\Gamma_{48}$ | $K_2^*(1430)^+\pi^-,$<br>$K_2^*(1430)^+ \rightarrow K_S^0\pi^+$ | [f] $< 3.4$                     | $\times 10^{-5}$ | CL=95% |
| $\Gamma_{49}$ | $K_S^0\pi^+\pi^-$ nonresonant                                   | $(2.6 \pm_{-1.6}^{6.0})$        | $\times 10^{-4}$ |        |
| $\Gamma_{50}$ | $K^-\pi^+\pi^0$   | [e] $(14.3 \pm 0.8)$            | %                | S=3.1  |
| $\Gamma_{51}$ | $K^-\rho^+$   | $(11.1 \pm 0.9)$                | %                |        |
| $\Gamma_{52}$ | $K^-\rho(1700)^+,$<br>$\rho(1700)^+ \rightarrow \pi^+\pi^0$     | $(8.1 \pm 1.8)$                 | $\times 10^{-3}$ |        |

|                 |   |  |       |
|-----------------|---|--|-------|
| Γ <sub>53</sub> | $K^*(892)^- \pi^+$ ,  | ( 2.28 $\pm$ 0.40 ) %                  |       |
|                 | $K^*(892)^- \rightarrow K^- \pi^0$                              |  |       |
| Γ <sub>54</sub> | $\bar{K}^*(892)^0 \pi^0$ ,                                      | ( 1.93 $\pm$ 0.26 ) %                  |       |
|                 | $\bar{K}^*(892)^0 \rightarrow K^- \pi^+$                        |  |       |
| Γ <sub>55</sub> | $K_0^*(1430)^- \pi^+$ ,   | ( 4.7 $\pm$ 2.2 ) $\times 10^{-3}$     |       |
|                 | $K_0^*(1430)^- \rightarrow K^- \pi^0$                           |  |       |
| Γ <sub>56</sub> | $\bar{K}_0^*(1430)^0 \pi^0$ ,                                   | ( 5.8 $\pm$ 5.0 ) $\times 10^{-3}$     |       |
|                 | $\bar{K}_0^*(1430)^0 \rightarrow K^- \pi^+$                     |  |       |
| Γ <sub>57</sub> | $K^*(1680)^- \pi^+$ ,   | ( 1.9 $\pm$ 0.7 ) $\times 10^{-3}$     |       |
|                 | $K^*(1680)^- \rightarrow K^- \pi^0$                             |  |       |
| Γ <sub>58</sub> | $K^- \pi^+ \pi^0$ nonresonant                                   | ( 1.14 $\pm$ 0.50 ) %                  |       |
| Γ <sub>59</sub> | $K_S^0 2\pi^0$  | ( 9.1 $\pm$ 1.1 ) $\times 10^{-3}$     | S=2.2 |
| Γ <sub>60</sub> | $K_S^0 (2\pi^0)$ -S-wave  | ( 2.6 $\pm$ 0.7 ) $\times 10^{-3}$     |       |
| Γ <sub>61</sub> | $\bar{K}^*(892)^0 \pi^0$ ,                                      | ( 7.9 $\pm$ 0.7 ) $\times 10^{-3}$     |       |
|                 | $\bar{K}^*(892)^0 \rightarrow K_S^0 \pi^0$                      |  |       |
| Γ <sub>62</sub> | $\bar{K}^*(1430)^0 \pi^0, \bar{K}^{*0} \rightarrow K_S^0 \pi^0$ | ( 4 $\pm$ 23 ) $\times 10^{-5}$        |       |
| Γ <sub>63</sub> | $\bar{K}^*(1680)^0 \pi^0, \bar{K}^{*0} \rightarrow K_S^0 \pi^0$ | ( 1.0 $\pm$ 0.4 ) $\times 10^{-3}$     |       |
| Γ <sub>64</sub> | $K_S^0 f_2(1270), f_2 \rightarrow 2\pi^0$                       | ( 2.3 $\pm$ 1.1 ) $\times 10^{-4}$     |       |
| Γ <sub>65</sub> | $2K_S^0$ , one $K_S^0 \rightarrow 2\pi^0$                       | ( 3.2 $\pm$ 1.1 ) $\times 10^{-4}$     |       |
| Γ <sub>66</sub> | $K_S^0 2\pi^0$ nonresonant                                      |  |       |
| Γ <sub>67</sub> | $K^- 2\pi^+ \pi^-$  | [e] ( 8.07 $\pm$ 0.23 ) %              | S=1.5 |
| Γ <sub>68</sub> | $K^- \pi^+ \rho^0$ total  | ( 6.74 $\pm$ 0.34 ) %                  |       |
| Γ <sub>69</sub> | $K^- \pi^+ \rho^0$ 3-body                                       | ( 5.1 $\pm$ 2.3 ) $\times 10^{-3}$     |       |
| Γ <sub>70</sub> | $\bar{K}^*(892)^0 \rho^0$ ,                                     | ( 1.05 $\pm$ 0.23 ) %                  |       |
|                 | $\bar{K}^*(892)^0 \rightarrow K^- \pi^+$                        |  |       |
| Γ <sub>71</sub> | $K^- a_1(1260)^+$ ,   | ( 3.6 $\pm$ 0.6 ) %                    |       |
|                 | $a_1(1260)^+ \rightarrow 2\pi^+ \pi^-$                          |  |       |
| Γ <sub>72</sub> | $\bar{K}^*(892)^0 \pi^+ \pi^-$ total,                           | ( 1.6 $\pm$ 0.4 ) %                    |       |
|                 | $\bar{K}^*(892)^0 \rightarrow K^- \pi^+$                        |  |       |
| Γ <sub>73</sub> | $\bar{K}^*(892)^0 \pi^+ \pi^-$ 3-body,                          | ( 9.9 $\pm$ 2.3 ) $\times 10^{-3}$     |       |
|                 | $\bar{K}^*(892)^0 \rightarrow K^- \pi^+$                        |  |       |
| Γ <sub>74</sub> | $K_1(1270)^- \pi^+$ ,   | [g] ( 2.9 $\pm$ 0.3 ) $\times 10^{-3}$ |       |
|                 | $K_1(1270)^- \rightarrow K^- \pi^+ \pi^-$                       |  |       |
| Γ <sub>75</sub> | $K^- 2\pi^+ \pi^-$ nonresonant                                  | ( 1.88 $\pm$ 0.26 ) %                  |       |
| Γ <sub>76</sub> | $K_S^0 \pi^+ \pi^- \pi^0$                                       | [h] ( 5.2 $\pm$ 0.6 ) %                |       |
| Γ <sub>77</sub> | $K_S^0 \eta, \eta \rightarrow \pi^+ \pi^- \pi^0$                | ( 1.02 $\pm$ 0.09 ) $\times 10^{-3}$   |       |
| Γ <sub>78</sub> | $K_S^0 \omega, \omega \rightarrow \pi^+ \pi^- \pi^0$            | ( 9.9 $\pm$ 0.5 ) $\times 10^{-3}$     |       |
| Γ <sub>79</sub> | $K^- \pi^+ 2\pi^0$  |  |       |
| Γ <sub>80</sub> | $K^- 2\pi^+ \pi^- \pi^0$  | ( 4.2 $\pm$ 0.4 ) %                    |       |
| Γ <sub>81</sub> | $\bar{K}^*(892)^0 \pi^+ \pi^- \pi^0$ ,                          | ( 1.3 $\pm$ 0.6 ) %                    |       |
|                 | $\bar{K}^*(892)^0 \rightarrow K^- \pi^+$                        |  |       |
| Γ <sub>82</sub> | $K^- \pi^+ \omega, \omega \rightarrow \pi^+ \pi^- \pi^0$        | ( 2.7 $\pm$ 0.5 ) %                    |       |

|               |   |                                    |        |
|---------------|---|------------------------------------|--------|
| $\Gamma_{83}$ | $\bar{K}^*(892)^0 \omega,$<br>$\bar{K}^*(892)^0 \rightarrow K^- \pi^+,$<br>$\omega \rightarrow \pi^+ \pi^- \pi^0$ | $( 6.5 \pm 3.0 ) \times 10^{-3}$   |        |
| $\Gamma_{84}$ | $K_S^0 \eta \pi^0$  | $( 5.5 \pm 1.1 ) \times 10^{-3}$   |        |
| $\Gamma_{85}$ | $K_S^0 a_0(980), a_0(980) \rightarrow \eta \pi^0$   | $( 6.6 \pm 2.0 ) \times 10^{-3}$   |        |
| $\Gamma_{86}$ | $\bar{K}^*(892)^0 \eta, \bar{K}^*(892)^0 \rightarrow$<br>$K_S^0 \pi^0$  | $( 1.6 \pm 0.5 ) \times 10^{-3}$   |        |
| $\Gamma_{87}$ | $K_S^0 2\pi^+ 2\pi^-$   | $( 2.71 \pm 0.31 ) \times 10^{-3}$ |        |
| $\Gamma_{88}$ | $K_S^0 \rho^0 \pi^+ \pi^-, \text{ no } K^*(892)^-$  | $( 1.1 \pm 0.7 ) \times 10^{-3}$   |        |
| $\Gamma_{89}$ | $K^*(892)^- 2\pi^+ \pi^-,$<br>$K^*(892)^- \rightarrow K_S^0 \pi^-, \text{ no}$<br>$\rho^0$                        | $( 5 \pm 8 ) \times 10^{-4}$       |        |
| $\Gamma_{90}$ | $K^*(892)^- \rho^0 \pi^+,$<br>$K^*(892)^- \rightarrow K_S^0 \pi^-$  | $( 1.6 \pm 0.6 ) \times 10^{-3}$   |        |
| $\Gamma_{91}$ | $K_S^0 2\pi^+ 2\pi^- \text{ nonresonant}$   | $< 1.2 \times 10^{-3}$             | CL=90% |
| $\Gamma_{92}$ | $\bar{K}^0 \pi^+ \pi^- 2\pi^0 (\pi^0)$  |                                    |        |
| $\Gamma_{93}$ | $K^- 3\pi^+ 2\pi^-$   | $( 2.2 \pm 0.6 ) \times 10^{-4}$   |        |

Fractions of many of the following modes with resonances have already appeared above as submodes of particular charged-particle modes. (Modes for which there are only upper limits and  $\bar{K}^*(892)\rho$  submodes only appear below.)

|                |  |                                    |        |
|----------------|--|------------------------------------|--------|
| $\Gamma_{94}$  | $K_S^0 \eta$                                   | $( 4.85 \pm 0.30 ) \times 10^{-3}$ |        |
| $\Gamma_{95}$  | $K_S^0 \omega$                                 | $( 1.11 \pm 0.06 ) \%$             |        |
| $\Gamma_{96}$  | $K_S^0 \eta'(958)$                             | $( 9.5 \pm 0.5 ) \times 10^{-3}$   |        |
| $\Gamma_{97}$  | $K^- a_1(1260)^+$                              | $( 7.8 \pm 1.1 ) \%$               |        |
| $\Gamma_{98}$  | $K^- a_2(1320)^+$                              | $< 2 \times 10^{-3}$               | CL=90% |
| $\Gamma_{99}$  | $\bar{K}^*(892)^0 \pi^+ \pi^- \text{ total}$   | $( 2.4 \pm 0.5 ) \%$               |        |
| $\Gamma_{100}$ | $\bar{K}^*(892)^0 \pi^+ \pi^- 3\text{-body}$   | $( 1.48 \pm 0.34 ) \%$             |        |
| $\Gamma_{101}$ | $\bar{K}^*(892)^0 \rho^0$                      | $( 1.57 \pm 0.35 ) \%$             |        |
| $\Gamma_{102}$ | $\bar{K}^*(892)^0 \rho^0 \text{ transverse}$   | $( 1.7 \pm 0.6 ) \%$               |        |
| $\Gamma_{103}$ | $\bar{K}^*(892)^0 \rho^0 \text{ S-wave}$       | $( 3.0 \pm 0.6 ) \%$               |        |
| $\Gamma_{104}$ | $\bar{K}^*(892)^0 \rho^0 \text{ S-wave long.}$ | $< 3 \times 10^{-3}$               | CL=90% |
| $\Gamma_{105}$ | $\bar{K}^*(892)^0 \rho^0 \text{ P-wave}$       | $< 3 \times 10^{-3}$               | CL=90% |
| $\Gamma_{106}$ | $\bar{K}^*(892)^0 \rho^0 \text{ D-wave}$       | $( 2.1 \pm 0.6 ) \%$               |        |
| $\Gamma_{107}$ | $K^- \pi^+ f_0(980)$                           |                                    |        |
| $\Gamma_{108}$ | $\bar{K}^*(892)^0 f_0(980)$                    |                                    |        |
| $\Gamma_{109}$ | $K_1(1270)^- \pi^+$                            | [g] $( 1.6 \pm 0.8 ) \%$           |        |
| $\Gamma_{110}$ | $K_1(1400)^- \pi^+$                            | $< 1.2 \%$                         | CL=90% |
| $\Gamma_{111}$ | $K^*(1410)^- \pi^+$                            |                                    |        |
| $\Gamma_{112}$ | $\bar{K}^*(892)^0 \pi^+ \pi^- \pi^0$           | $( 1.9 \pm 0.9 ) \%$               |        |
| $\Gamma_{113}$ | $\bar{K}^*(892)^0 \eta$                        |                                    |        |

|                |                               |                                    |        |
|----------------|-------------------------------|------------------------------------|--------|
| $\Gamma_{114}$ | $K^- \pi^+ \omega$            | ( 3.1 $\pm$ 0.6 ) %                |        |
| $\Gamma_{115}$ | $\bar{K}^*(892)^0 \omega$     | ( 1.1 $\pm$ 0.5 ) %                |        |
| $\Gamma_{116}$ | $K^- \pi^+ \eta'(958)$        | ( 7.5 $\pm$ 1.9 ) $\times 10^{-3}$ |        |
| $\Gamma_{117}$ | $\bar{K}^*(892)^0 \eta'(958)$ | < 1.1 $\times 10^{-3}$             | CL=90% |

**Hadronic modes with three K's**

|                |   |                                      |        |
|----------------|---|--------------------------------------|--------|
| $\Gamma_{118}$ | $K_S^0 K^+ K^-$   | ( 4.51 $\pm$ 0.34 ) $\times 10^{-3}$ |        |
| $\Gamma_{119}$ | $K_S^0 a_0(980)^0, a_0^0 \rightarrow K^+ K^-$   | ( 3.0 $\pm$ 0.4 ) $\times 10^{-3}$   |        |
| $\Gamma_{120}$ | $K^- a_0(980)^+, a_0^+ \rightarrow K^+ K_S^0$   | ( 6.0 $\pm$ 1.8 ) $\times 10^{-4}$   |        |
| $\Gamma_{121}$ | $K^+ a_0(980)^-, a_0^- \rightarrow K^- K_S^0$   | < 1.1 $\times 10^{-4}$               | CL=95% |
| $\Gamma_{122}$ | $K_S^0 f_0(980), f_0 \rightarrow K^+ K^-$   | < 9 $\times 10^{-5}$                 | CL=95% |
| $\Gamma_{123}$ | $K_S^0 \phi, \phi \rightarrow K^+ K^-$  | ( 2.07 $\pm$ 0.16 ) $\times 10^{-3}$ |        |
| $\Gamma_{124}$ | $K_S^0 f_0(1370), f_0 \rightarrow K^+ K^-$  | ( 1.7 $\pm$ 1.1 ) $\times 10^{-4}$   |        |
| $\Gamma_{125}$ | $3K_S^0$  | ( 9.2 $\pm$ 1.3 ) $\times 10^{-4}$   |        |
| $\Gamma_{126}$ | $K^+ 2K^- \pi^+$  | ( 2.21 $\pm$ 0.32 ) $\times 10^{-4}$ |        |
| $\Gamma_{127}$ | $K^+ K^- \bar{K}^*(892)^0, \bar{K}^*(892)^0 \rightarrow K^- \pi^+$                        | ( 4.4 $\pm$ 1.7 ) $\times 10^{-5}$   |        |
| $\Gamma_{128}$ | $K^- \pi^+ \phi, \phi \rightarrow K^+ K^-$  | ( 4.0 $\pm$ 1.7 ) $\times 10^{-5}$   |        |
| $\Gamma_{129}$ | $\phi \bar{K}^*(892)^0, \phi \rightarrow K^+ K^-, \bar{K}^*(892)^0 \rightarrow K^- \pi^+$ | ( 1.06 $\pm$ 0.20 ) $\times 10^{-4}$ |        |
| $\Gamma_{130}$ | $K^+ 2K^- \pi^+$ nonresonant  | ( 3.3 $\pm$ 1.5 ) $\times 10^{-5}$   |        |
| $\Gamma_{131}$ | $2K_S^0 K^\pm \pi^\mp$  | ( 6.1 $\pm$ 1.3 ) $\times 10^{-4}$   |        |

**Pionic modes**

|                |  |  |       |
|----------------|--|--|-------|
| $\Gamma_{132}$ | $\pi^+ \pi^-$  | ( 1.421 $\pm$ 0.025 ) $\times 10^{-3}$ | S=1.1 |
| $\Gamma_{133}$ | $2\pi^0$   | ( 8.26 $\pm$ 0.35 ) $\times 10^{-4}$   |       |
| $\Gamma_{134}$ | $\pi^+ \pi^- \pi^0$  | ( 1.47 $\pm$ 0.09 ) %                  | S=3.0 |
| $\Gamma_{135}$ | $\rho^+ \pi^-$   | ( 1.00 $\pm$ 0.06 ) %                  |       |
| $\Gamma_{136}$ | $\rho^0 \pi^0$   | ( 3.82 $\pm$ 0.29 ) $\times 10^{-3}$   |       |
| $\Gamma_{137}$ | $\rho^- \pi^+$   | ( 5.09 $\pm$ 0.34 ) $\times 10^{-3}$   |       |
| $\Gamma_{138}$ | $\rho(1450)^+ \pi^-, \rho(1450)^+ \rightarrow \pi^+ \pi^0$ | ( 1.6 $\pm$ 2.0 ) $\times 10^{-5}$     |       |
| $\Gamma_{139}$ | $\rho(1450)^0 \pi^0, \rho(1450)^0 \rightarrow \pi^+ \pi^-$ | ( 4.4 $\pm$ 1.9 ) $\times 10^{-5}$     |       |
| $\Gamma_{140}$ | $\rho(1450)^- \pi^+, \rho(1450)^- \rightarrow \pi^- \pi^0$ | ( 2.6 $\pm$ 0.4 ) $\times 10^{-4}$     |       |
| $\Gamma_{141}$ | $\rho(1700)^+ \pi^-, \rho(1700)^+ \rightarrow \pi^+ \pi^0$ | ( 6.0 $\pm$ 1.5 ) $\times 10^{-4}$     |       |
| $\Gamma_{142}$ | $\rho(1700)^0 \pi^0, \rho(1700)^0 \rightarrow \pi^+ \pi^-$ | ( 7.4 $\pm$ 1.8 ) $\times 10^{-4}$     |       |
| $\Gamma_{143}$ | $\rho(1700)^- \pi^+, \rho(1700)^- \rightarrow \pi^- \pi^0$ | ( 4.7 $\pm$ 1.1 ) $\times 10^{-4}$     |       |
| $\Gamma_{144}$ | $f_0(980) \pi^0, f_0(980) \rightarrow \pi^+ \pi^-$         | ( 3.7 $\pm$ 0.9 ) $\times 10^{-5}$     |       |
| $\Gamma_{145}$ | $f_0(500) \pi^0, f_0(500) \rightarrow \pi^+ \pi^-$         | ( 1.21 $\pm$ 0.22 ) $\times 10^{-4}$   |       |
| $\Gamma_{146}$ | $(\pi^+ \pi^-)_{S\text{-wave}} \pi^0$                      |  |       |

|                |  |  |        |
|----------------|--|--|--------|
| $\Gamma_{147}$ | $f_0(1370)\pi^0, f_0(1370) \rightarrow \pi^+\pi^-$       | $( 5.4 \pm 2.1 ) \times 10^{-5}$       |        |
| $\Gamma_{148}$ | $f_0(1500)\pi^0, f_0(1500) \rightarrow \pi^+\pi^-$       | $( 5.7 \pm 1.6 ) \times 10^{-5}$       |        |
| $\Gamma_{149}$ | $f_0(1710)\pi^0, f_0(1710) \rightarrow \pi^+\pi^-$       | $( 4.6 \pm 1.6 ) \times 10^{-5}$       |        |
| $\Gamma_{150}$ | $f_2(1270)\pi^0, f_2(1270) \rightarrow \pi^+\pi^-$       | $( 1.94 \pm 0.22 ) \times 10^{-4}$     |        |
| $\Gamma_{151}$ | $\pi^+\pi^-\pi^0$ nonresonant                            | $( 1.2 \pm 0.4 ) \times 10^{-4}$       |        |
| $\Gamma_{152}$ | $3\pi^0$   | $< 3.5 \times 10^{-4}$                 | CL=90% |
| $\Gamma_{153}$ | $2\pi^+2\pi^-$   | $( 7.45 \pm 0.22 ) \times 10^{-3}$     | S=1.2  |
| $\Gamma_{154}$ | $a_1(1260)^+\pi^-, a_1^+ \rightarrow 2\pi^+\pi^-$ total  | $( 4.47 \pm 0.32 ) \times 10^{-3}$     |        |
| $\Gamma_{155}$ | $a_1(1260)^+\pi^-, a_1^+ \rightarrow \rho^0\pi^+$ S-wave | $( 3.23 \pm 0.25 ) \times 10^{-3}$     |        |
| $\Gamma_{156}$ | $a_1(1260)^+\pi^-, a_1^+ \rightarrow \rho^0\pi^+$ D-wave | $( 1.9 \pm 0.5 ) \times 10^{-4}$       |        |
| $\Gamma_{157}$ | $a_1(1260)^+\pi^-, a_1^+ \rightarrow \sigma\pi^+$        | $( 6.2 \pm 0.7 ) \times 10^{-4}$       |        |
| $\Gamma_{158}$ | $2\rho^0$ total  | $( 1.83 \pm 0.13 ) \times 10^{-3}$     |        |
| $\Gamma_{159}$ | $2\rho^0$ , parallel helicities                          | $( 8.2 \pm 3.2 ) \times 10^{-5}$       |        |
| $\Gamma_{160}$ | $2\rho^0$ , perpendicular helicities                     | $( 4.8 \pm 0.6 ) \times 10^{-4}$       |        |
| $\Gamma_{161}$ | $2\rho^0$ , longitudinal helicities                      | $( 1.25 \pm 0.10 ) \times 10^{-3}$     |        |
| $\Gamma_{162}$ | Resonant $(\pi^+\pi^-)\pi^+\pi^-$ 3-body total           | $( 1.49 \pm 0.12 ) \times 10^{-3}$     |        |
| $\Gamma_{163}$ | $\sigma\pi^+\pi^-$                                       | $( 6.1 \pm 0.9 ) \times 10^{-4}$       |        |
| $\Gamma_{164}$ | $f_0(980)\pi^+\pi^-, f_0 \rightarrow \pi^+\pi^-$         | $( 1.8 \pm 0.5 ) \times 10^{-4}$       |        |
| $\Gamma_{165}$ | $f_2(1270)\pi^+\pi^-, f_2 \rightarrow \pi^+\pi^-$        | $( 3.7 \pm 0.6 ) \times 10^{-4}$       |        |
| $\Gamma_{166}$ | $\pi^+\pi^-2\pi^0$                                       | $( 1.01 \pm 0.09 ) \%$                 |        |
| $\Gamma_{167}$ | $\eta\pi^0$  | $[i] ( 6.9 \pm 0.7 ) \times 10^{-4}$   |        |
| $\Gamma_{168}$ | $\omega\pi^0$  | $[i] < 2.6 \times 10^{-4}$             | CL=90% |
| $\Gamma_{169}$ | $2\pi^+2\pi^-\pi^0$                                      | $( 4.2 \pm 0.5 ) \times 10^{-3}$       |        |
| $\Gamma_{170}$ | $\eta\pi^+\pi^-$   | $[i] ( 1.09 \pm 0.16 ) \times 10^{-3}$ |        |
| $\Gamma_{171}$ | $\omega\pi^+\pi^-$                                       | $[i] ( 1.6 \pm 0.5 ) \times 10^{-3}$   |        |
| $\Gamma_{172}$ | $3\pi^+3\pi^-$   | $( 4.2 \pm 1.2 ) \times 10^{-4}$       |        |
| $\Gamma_{173}$ | $\eta'(958)\pi^0$  | $( 9.1 \pm 1.4 ) \times 10^{-4}$       |        |
| $\Gamma_{174}$ | $\eta'(958)\pi^+\pi^-$                                   | $( 4.5 \pm 1.7 ) \times 10^{-4}$       |        |
| $\Gamma_{175}$ | $2\eta$  | $( 1.70 \pm 0.20 ) \times 10^{-3}$     |        |
| $\Gamma_{176}$ | $\eta\eta'(958)$   | $( 1.07 \pm 0.26 ) \times 10^{-3}$     |        |



**Hadronic modes with a  $K\bar{K}$  pair**

|                |  |                                    |        |
|----------------|--|------------------------------------|--------|
| $\Gamma_{177}$ | $K^+ K^-$  | $( 4.01 \pm 0.07 ) \times 10^{-3}$ | S=1.4  |
| $\Gamma_{178}$ | $2K_S^0$   | $( 1.8 \pm 0.4 ) \times 10^{-4}$   | S=2.5  |
| $\Gamma_{179}$ | $K_S^0 K^- \pi^+$  | $( 3.6 \pm 0.5 ) \times 10^{-3}$   | S=1.2  |
| $\Gamma_{180}$ | $\bar{K}^*(892)^0 K_S^0, \bar{K}^{*0} \rightarrow$<br>$K^- \pi^+$        | $< 5 \times 10^{-4}$               | CL=90% |
| $\Gamma_{181}$ | $K_S^0 K^+ \pi^-$  | $( 2.2 \pm 0.4 ) \times 10^{-3}$   | S=1.3  |
| $\Gamma_{182}$ | $K^*(892)^0 K_S^0, K^{*0} \rightarrow$<br>$K^+ \pi^-$                    | $< 1.8 \times 10^{-4}$             | CL=90% |
| $\Gamma_{183}$ | $K^+ K^- \pi^0$  | $( 3.38 \pm 0.21 ) \times 10^{-3}$ |        |
| $\Gamma_{184}$ | $K^*(892)^+ K^-, K^*(892)^+ \rightarrow$<br>$K^+ \pi^0$                  | $( 1.50 \pm 0.10 ) \times 10^{-3}$ |        |
| $\Gamma_{185}$ | $K^*(892)^- K^+, K^*(892)^- \rightarrow$<br>$K^- \pi^0$                  | $( 5.4 \pm 0.5 ) \times 10^{-4}$   |        |
| $\Gamma_{186}$ | $(K^+ \pi^0)_{S-wave} K^-$   | $( 2.40 \pm 0.21 ) \times 10^{-3}$ |        |
| $\Gamma_{187}$ | $(K^- \pi^0)_{S-wave} K^+$   | $( 1.3 \pm 0.5 ) \times 10^{-4}$   |        |
| $\Gamma_{188}$ | $f_0(980) \pi^0, f_0 \rightarrow K^+ K^-$                                | $( 3.5 \pm 0.6 ) \times 10^{-4}$   |        |
| $\Gamma_{189}$ | $\phi \pi^0, \phi \rightarrow K^+ K^-$                                   | $( 6.6 \pm 0.5 ) \times 10^{-4}$   |        |
| $\Gamma_{190}$ | $K^+ K^- \pi^0$ nonresonant  |                                    |        |
| $\Gamma_{191}$ | $2K_S^0 \pi^0$   | $< 5.9 \times 10^{-4}$             |        |
| $\Gamma_{192}$ | $K^+ K^- \pi^+ \pi^-$  | $( 2.42 \pm 0.12 ) \times 10^{-3}$ |        |
| $\Gamma_{193}$ | $\phi(\pi^+ \pi^-)_{S-wave}, \phi \rightarrow$<br>$K^+ K^-$              | $( 2.50 \pm 0.34 ) \times 10^{-4}$ |        |
| $\Gamma_{194}$ | $(\phi \rho^0)_{S-wave}, \phi \rightarrow K^+ K^-$                       | $( 9.3 \pm 1.2 ) \times 10^{-4}$   |        |
| $\Gamma_{195}$ | $(\phi \rho^0)_{D-wave}, \phi \rightarrow K^+ K^-$                       | $( 8.2 \pm 2.3 ) \times 10^{-5}$   |        |
| $\Gamma_{196}$ | $(K^{*0} \bar{K}^{*0})_{S-wave}, K^{*0} \rightarrow$<br>$K^\pm \pi^\mp$  | $( 1.48 \pm 0.30 ) \times 10^{-4}$ |        |
| $\Gamma_{197}$ | $(K^- \pi^+)_{P-wave},$<br>$(K^+ \pi^-)_{S-wave},$                       | $( 2.6 \pm 0.5 ) \times 10^{-4}$   |        |
| $\Gamma_{198}$ | $K_1(1270)^+ K^-,$<br>$K_1(1270)^+ \rightarrow K^{*0} \pi^+$             | $( 1.8 \pm 0.5 ) \times 10^{-4}$   |        |
| $\Gamma_{199}$ | $K_1(1270)^+ K^-,$<br>$K_1(1270)^+ \rightarrow \rho^0 K^+$               | $( 1.14 \pm 0.26 ) \times 10^{-4}$ |        |
| $\Gamma_{200}$ | $K_1(1270)^- K^+,$<br>$K_1(1270)^- \rightarrow \bar{K}^{*0} \pi^-$       | $( 2.2 \pm 1.2 ) \times 10^{-5}$   |        |
| $\Gamma_{201}$ | $K_1(1270)^- K^+,$<br>$K_1(1270)^- \rightarrow \rho^0 K^-$               | $( 1.45 \pm 0.25 ) \times 10^{-4}$ |        |
| $\Gamma_{202}$ | $K^*(1410)^+ K^-,$<br>$K^*(1410)^+ \rightarrow K^{*0} \pi^+$             | $( 1.02 \pm 0.26 ) \times 10^{-4}$ |        |
| $\Gamma_{203}$ | $K^*(1410)^- K^+,$<br>$K^*(1410)^- \rightarrow \bar{K}^{*0} \pi^-$       | $( 1.14 \pm 0.25 ) \times 10^{-4}$ |        |
| $\Gamma_{204}$ | $K^+ K^- \rho^0$ 3-body  |                                    |        |
| $\Gamma_{205}$ | $f_0(980) \pi^+ \pi^-, f_0 \rightarrow K^+ K^-$                          |                                    |        |
| $\Gamma_{206}$ | $K^*(892)^0 K^\mp \pi^\pm$ 3-body,<br>$K^{*0} \rightarrow K^\pm \pi^\mp$ |                                    |        |

|                |   |                                  |        |
|----------------|---|----------------------------------|--------|
| $\Gamma_{207}$ | $K^*(892)^0 \bar{K}^*(892)^0, K^{*0} \rightarrow$<br>$K^\pm \pi^\mp$    |                                  |        |
| $\Gamma_{208}$ | $K_1(1270)^\pm K^\mp,$<br>$K_1(1270)^\pm \rightarrow K^\pm \pi^+ \pi^-$ |                                  |        |
| $\Gamma_{209}$ | $K_1(1400)^\pm K^\mp,$<br>$K_1(1400)^\pm \rightarrow K^\pm \pi^+ \pi^-$ |                                  |        |
| $\Gamma_{210}$ | $2K_S^0 \pi^+ \pi^-$  | $(1.24 \pm 0.24) \times 10^{-3}$ |        |
| $\Gamma_{211}$ | $K_S^0 K^- 2\pi^+ \pi^-$  | $< 1.5 \times 10^{-4}$           | CL=90% |
| $\Gamma_{212}$ | $K^+ K^- \pi^+ \pi^- \pi^0$   | $(3.1 \pm 2.0) \times 10^{-3}$   |        |

Other  $K\bar{K}X$  modes. They include all decay modes of the  $\phi$ ,  $\eta$ , and  $\omega$ .

|                |               |                                |        |
|----------------|---------------|--------------------------------|--------|
| $\Gamma_{213}$ | $\phi \pi^0$  |                                |        |
| $\Gamma_{214}$ | $\phi \eta$   | $(1.4 \pm 0.5) \times 10^{-4}$ |        |
| $\Gamma_{215}$ | $\phi \omega$ | $< 2.1 \times 10^{-3}$         | CL=90% |

### Radiative modes

|                |                           |                                  |        |
|----------------|---------------------------|----------------------------------|--------|
| $\Gamma_{216}$ | $\rho^0 \gamma$           | $< 2.4 \times 10^{-4}$           | CL=90% |
| $\Gamma_{217}$ | $\omega \gamma$           | $< 2.4 \times 10^{-4}$           | CL=90% |
| $\Gamma_{218}$ | $\phi \gamma$             | $(2.73 \pm 0.35) \times 10^{-5}$ |        |
| $\Gamma_{219}$ | $\bar{K}^*(892)^0 \gamma$ | $(3.31 \pm 0.34) \times 10^{-4}$ |        |

### Doubly Cabibbo suppressed (DC) modes or $\Delta C = 2$ forbidden via mixing (C2M) modes

|                |   |   |        |
|----------------|---|---|--------|
| $\Gamma_{220}$ | $K^+ \ell^- \bar{\nu}_\ell$ via $\bar{D}^0$                       | $< 2.2 \times 10^{-5}$                        | CL=90% |
| $\Gamma_{221}$ | $K^+$ or $K^*(892)^+$ $e^- \bar{\nu}_e$ via $\bar{D}^0$           | $< 6 \times 10^{-5}$                          | CL=90% |
| $\Gamma_{222}$ | $K^+ \pi^-$   | DC $(1.49 \pm 0.07) \times 10^{-4}$           | S=2.8  |
| $\Gamma_{223}$ | $K^+ \pi^-$ via DCS   | $(1.33 \pm 0.09) \times 10^{-4}$              |        |
| $\Gamma_{224}$ | $K^+ \pi^-$ via $\bar{D}^0$                                       | $< 1.6 \times 10^{-5}$                        | CL=95% |
| $\Gamma_{225}$ | $K_S^0 \pi^+ \pi^-$ in $D^0 \rightarrow \bar{D}^0$                | $< 1.8 \times 10^{-4}$                        | CL=95% |
| $\Gamma_{226}$ | $K^*(892)^+ \pi^-,$<br>$K^*(892)^+ \rightarrow K_S^0 \pi^+$       | DC $(1.15 \pm_{-0.34}^{0.60}) \times 10^{-4}$ |        |
| $\Gamma_{227}$ | $K_0^*(1430)^+ \pi^-,$<br>$K_0^*(1430)^+ \rightarrow K_S^0 \pi^+$ | DC $< 1.4 \times 10^{-5}$                     |        |
| $\Gamma_{228}$ | $K_2^*(1430)^+ \pi^-,$<br>$K_2^*(1430)^+ \rightarrow K_S^0 \pi^+$ | DC $< 3.4 \times 10^{-5}$                     |        |
| $\Gamma_{229}$ | $K^+ \pi^- \pi^0$   | DC $(3.13 \pm 0.23) \times 10^{-4}$           |        |
| $\Gamma_{230}$ | $K^+ \pi^- \pi^0$ via $\bar{D}^0$                                 | $(7.5 \pm 0.6) \times 10^{-4}$                |        |
| $\Gamma_{231}$ | $K^+ \pi^+ 2\pi^-$  | DC $(2.62 \pm 0.11) \times 10^{-4}$           |        |
| $\Gamma_{232}$ | $K^+ \pi^+ 2\pi^-$ via $\bar{D}^0$                                | $< 4 \times 10^{-4}$                          | CL=90% |
| $\Gamma_{233}$ | $K^+ \pi^-$ or $K^+ \pi^+ 2\pi^-$ via $\bar{D}^0$                 |   |        |
| $\Gamma_{234}$ | $\mu^-$ anything via $\bar{D}^0$                                  | $< 4 \times 10^{-4}$                          | CL=90% |

**$\Delta C = 1$  weak neutral current (C1) modes,  
Lepton Family number (LF) violating modes,  
Lepton (L) or Baryon (B) number violating modes**

|                  |                                |    |            |                  |        |
|------------------|--------------------------------|----|------------|------------------|--------|
| Γ <sub>235</sub> | $\gamma\gamma$                 | C1 | < 2.2      | $\times 10^{-6}$ | CL=90% |
| Γ <sub>236</sub> | $e^+e^-$                       | C1 | < 7.9      | $\times 10^{-8}$ | CL=90% |
| Γ <sub>237</sub> | $\mu^+\mu^-$                   | C1 | < 6.2      | $\times 10^{-9}$ | CL=90% |
| Γ <sub>238</sub> | $\pi^0e^+e^-$                  | C1 | < 4.5      | $\times 10^{-5}$ | CL=90% |
| Γ <sub>239</sub> | $\pi^0\mu^+\mu^-$              | C1 | < 1.8      | $\times 10^{-4}$ | CL=90% |
| Γ <sub>240</sub> | $\eta e^+e^-$                  | C1 | < 1.1      | $\times 10^{-4}$ | CL=90% |
| Γ <sub>241</sub> | $\eta\mu^+\mu^-$               | C1 | < 5.3      | $\times 10^{-4}$ | CL=90% |
| Γ <sub>242</sub> | $\pi^+\pi^-e^+e^-$             | C1 | < 3.73     | $\times 10^{-4}$ | CL=90% |
| Γ <sub>243</sub> | $\rho^0e^+e^-$                 | C1 | < 1.0      | $\times 10^{-4}$ | CL=90% |
| Γ <sub>244</sub> | $\pi^+\pi^-\mu^+\mu^-$         | C1 | < 5.5      | $\times 10^{-7}$ | CL=90% |
| Γ <sub>245</sub> | $\rho^0\mu^+\mu^-$             | C1 | < 2.2      | $\times 10^{-5}$ | CL=90% |
| Γ <sub>246</sub> | $\omega e^+e^-$                | C1 | < 1.8      | $\times 10^{-4}$ | CL=90% |
| Γ <sub>247</sub> | $\omega\mu^+\mu^-$             | C1 | < 8.3      | $\times 10^{-4}$ | CL=90% |
| Γ <sub>248</sub> | $K^-K^+e^+e^-$                 | C1 | < 3.15     | $\times 10^{-4}$ | CL=90% |
| Γ <sub>249</sub> | $\phi e^+e^-$                  | C1 | < 5.2      | $\times 10^{-5}$ | CL=90% |
| Γ <sub>250</sub> | $K^-K^+\mu^+\mu^-$             | C1 | < 3.3      | $\times 10^{-5}$ | CL=90% |
| Γ <sub>251</sub> | $\phi\mu^+\mu^-$               | C1 | < 3.1      | $\times 10^{-5}$ | CL=90% |
| Γ <sub>252</sub> | $\bar{K}^0e^+e^-$              |    | [j] < 1.1  | $\times 10^{-4}$ | CL=90% |
| Γ <sub>253</sub> | $\bar{K}^0\mu^+\mu^-$          |    | [j] < 2.6  | $\times 10^{-4}$ | CL=90% |
| Γ <sub>254</sub> | $K^-\pi^+e^+e^-$               | C1 | < 3.85     | $\times 10^{-4}$ | CL=90% |
| Γ <sub>255</sub> | $\bar{K}^*(892)^0e^+e^-$       |    | [j] < 4.7  | $\times 10^{-5}$ | CL=90% |
| Γ <sub>256</sub> | $K^-\pi^+\mu^+\mu^-$           | C1 | < 3.59     | $\times 10^{-4}$ | CL=90% |
| Γ <sub>257</sub> | $\bar{K}^*(892)^0\mu^+\mu^-$   |    | [j] < 2.4  | $\times 10^{-5}$ | CL=90% |
| Γ <sub>258</sub> | $\pi^+\pi^-\pi^0\mu^+\mu^-$    | C1 | < 8.1      | $\times 10^{-4}$ | CL=90% |
| Γ <sub>259</sub> | $\mu^\pm e^\mp$                | LF | [k] < 2.6  | $\times 10^{-7}$ | CL=90% |
| Γ <sub>260</sub> | $\pi^0e^\pm\mu^\mp$            | LF | [k] < 8.6  | $\times 10^{-5}$ | CL=90% |
| Γ <sub>261</sub> | $\eta e^\pm\mu^\mp$            | LF | [k] < 1.0  | $\times 10^{-4}$ | CL=90% |
| Γ <sub>262</sub> | $\pi^+\pi^-e^\pm\mu^\mp$       | LF | [k] < 1.5  | $\times 10^{-5}$ | CL=90% |
| Γ <sub>263</sub> | $\rho^0e^\pm\mu^\mp$           | LF | [k] < 4.9  | $\times 10^{-5}$ | CL=90% |
| Γ <sub>264</sub> | $\omega e^\pm\mu^\mp$          | LF | [k] < 1.2  | $\times 10^{-4}$ | CL=90% |
| Γ <sub>265</sub> | $K^-K^+e^\pm\mu^\mp$           | LF | [k] < 1.8  | $\times 10^{-4}$ | CL=90% |
| Γ <sub>266</sub> | $\phi e^\pm\mu^\mp$            | LF | [k] < 3.4  | $\times 10^{-5}$ | CL=90% |
| Γ <sub>267</sub> | $\bar{K}^0e^\pm\mu^\mp$        | LF | [k] < 1.0  | $\times 10^{-4}$ | CL=90% |
| Γ <sub>268</sub> | $K^-\pi^+e^\pm\mu^\mp$         | LF | [k] < 5.53 | $\times 10^{-4}$ | CL=90% |
| Γ <sub>269</sub> | $\bar{K}^*(892)^0e^\pm\mu^\mp$ | LF | [k] < 8.3  | $\times 10^{-5}$ | CL=90% |
| Γ <sub>270</sub> | $2\pi^-2e^+ + c.c.$            | L  | < 1.12     | $\times 10^{-4}$ | CL=90% |
| Γ <sub>271</sub> | $2\pi^-2\mu^+ + c.c.$          | L  | < 2.9      | $\times 10^{-5}$ | CL=90% |
| Γ <sub>272</sub> | $K^-\pi^-2e^+ + c.c.$          | L  | < 2.06     | $\times 10^{-4}$ | CL=90% |
| Γ <sub>273</sub> | $K^-\pi^-2\mu^+ + c.c.$        | L  | < 3.9      | $\times 10^{-4}$ | CL=90% |
| Γ <sub>274</sub> | $2K^-2e^+ + c.c.$              | L  | < 1.52     | $\times 10^{-4}$ | CL=90% |
| Γ <sub>275</sub> | $2K^-2\mu^+ + c.c.$            | L  | < 9.4      | $\times 10^{-5}$ | CL=90% |

|                |                                       |        |             |                  |        |
|----------------|---------------------------------------|--------|-------------|------------------|--------|
| $\Gamma_{276}$ | $\pi^- \pi^- e^+ \mu^+ + \text{c.c.}$ | $L$    | $< 7.9$     | $\times 10^{-5}$ | CL=90% |
| $\Gamma_{277}$ | $K^- \pi^- e^+ \mu^+ + \text{c.c.}$   | $L$    | $< 2.18$    | $\times 10^{-4}$ | CL=90% |
| $\Gamma_{278}$ | $2K^- e^+ \mu^+ + \text{c.c.}$        | $L$    | $< 5.7$     | $\times 10^{-5}$ | CL=90% |
| $\Gamma_{279}$ | $\rho e^-$                            | $L, B$ | $[l] < 1.0$ | $\times 10^{-5}$ | CL=90% |
| $\Gamma_{280}$ | $\bar{\rho} e^+$                      | $L, B$ | $[n] < 1.1$ | $\times 10^{-5}$ | CL=90% |

$\Gamma_{281}$  Unaccounted decay modes  $(37.5 \pm 1.5) \%$   $S=1.3$

- [a] This value is obtained by subtracting the branching fractions for 2-, 4- and 6-prongs from unity.
  - [b] This is the sum of our  $K^- 2\pi^+ \pi^-$ ,  $K^- 2\pi^+ \pi^- \pi^0$ ,  $\bar{K}^0 2\pi^+ 2\pi^-$ ,  $K^+ 2K^- \pi^+$ ,  $2\pi^+ 2\pi^-$ ,  $2\pi^+ 2\pi^- \pi^0$ ,  $K^+ K^- \pi^+ \pi^-$ , and  $K^+ K^- \pi^+ \pi^- \pi^0$ , branching fractions.
  - [c] This is the sum of our  $K^- 3\pi^+ 2\pi^-$  and  $3\pi^+ 3\pi^-$  branching fractions.
  - [d] The branching fractions for the  $K^- e^+ \nu_e$ ,  $K^*(892)^- e^+ \nu_e$ ,  $\pi^- e^+ \nu_e$ , and  $\rho^- e^+ \nu_e$  modes add up to  $6.19 \pm 0.17 \%$ .
  - [e] The branching fraction for this mode may differ from the sum of the submodes that contribute to it, due to interference effects. See the relevant papers.
  - [f] This is a doubly Cabibbo-suppressed mode.
  - [g] The two experiments measuring this fraction are in serious disagreement. See the Particle Listings.
  - [h] Submodes of the  $D^0 \rightarrow K_S^0 \pi^+ \pi^- \pi^0$  mode with a  $K^*$  and/or  $\rho$  were studied by COFFMAN 92B, but with only 140 events. With nothing new for 18 years, we refer to our 2008 edition, *Physics Letters* **B667** 1 (2008), for those results.
  - [i] This branching fraction includes all the decay modes of the resonance in the final state.
  - [j] This mode is not a useful test for a  $\Delta C=1$  weak neutral current because both quarks must change flavor in this decay.
  - [k] The value is for the sum of the charge states or particle/antiparticle states indicated.
  - [l] This limit is for either  $D^0$  or  $\bar{D}^0$  to  $\rho e^-$ .
  - [n] This limit is for either  $D^0$  or  $\bar{D}^0$  to  $\bar{\rho} e^+$ .
-

### CONSTRAINED FIT INFORMATION

An overall fit to 54 branching ratios uses 106 measurements and one constraint to determine 31 parameters. The overall fit has a  $\chi^2 = 103.8$  for 76 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients  $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$ , 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.

|      |     |     |     |     |     |     |     |     |     |     |  |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| x18  | 1   |     |     |     |     |     |     |     |     |     |  |
| x19  | 20  | 5   |     |     |     |     |     |     |     |     |  |
| x20  | 0   | 1   | 0   |     |     |     |     |     |     |     |  |
| x28  | 0   | 0   | 0   | 0   |     |     |     |     |     |     |  |
| x29  | 3   | 1   | 17  | 0   | 0   |     |     |     |     |     |  |
| x31  | 3   | 33  | 16  | 2   | 0   | 3   |     |     |     |     |  |
| x33  | 1   | 10  | 5   | 2   | 0   | 1   | 32  |     |     |     |  |
| x35  | 0   | 4   | 2   | 15  | 0   | 0   | 12  | 15  |     |     |  |
| x50  | 0   | 1   | 1   | 0   | 0   | 0   | 5   | 1   | 1   |     |  |
| x67  | 1   | 7   | 4   | 0   | 0   | 1   | 22  | 7   | 3   | 1   |  |
| x76  | 0   | 2   | 1   | 6   | 0   | 0   | 5   | 6   | 40  | 0   |  |
| x80  | 0   | 3   | 1   | 0   | 0   | 0   | 8   | 3   | 1   | 0   |  |
| x94  | 1   | 5   | 3   | 0   | 0   | 0   | 17  | 5   | 2   | 1   |  |
| x95  | 0   | 0   | 0   | 1   | 0   | 0   | 1   | 1   | 5   | 0   |  |
| x96  | 1   | 6   | 3   | 3   | 0   | 1   | 19  | 8   | 20  | 1   |  |
| x132 | 2   | 19  | 10  | 1   | 0   | 2   | 58  | 19  | 7   | 3   |  |
| x133 | 0   | 4   | 2   | 0   | 0   | 0   | 13  | 4   | 2   | 1   |  |
| x134 | 0   | 2   | 1   | 0   | 0   | 0   | 5   | 2   | 1   | 92  |  |
| x153 | 1   | 9   | 4   | 0   | 0   | 1   | 26  | 8   | 3   | 1   |  |
| x167 | 0   | 3   | 2   | 0   | 0   | 0   | 10  | 3   | 1   | 0   |  |
| x173 | 0   | 2   | 1   | 0   | 0   | 0   | 7   | 2   | 1   | 0   |  |
| x175 | 0   | 3   | 1   | 0   | 0   | 0   | 9   | 3   | 1   | 0   |  |
| x176 | 0   | 1   | 1   | 0   | 0   | 0   | 4   | 1   | 1   | 0   |  |
| x177 | 2   | 18  | 9   | 1   | 0   | 2   | 56  | 18  | 7   | 3   |  |
| x178 | 0   | 1   | 1   | 1   | 0   | 0   | 4   | 2   | 8   | 0   |  |
| x179 | 0   | 2   | 1   | 6   | 0   | 0   | 6   | 6   | 38  | 0   |  |
| x181 | 0   | 2   | 1   | 5   | 0   | 0   | 5   | 6   | 35  | 0   |  |
| x218 | 0   | 3   | 1   | 0   | 0   | 0   | 8   | 3   | 1   | 0   |  |
| x222 | 1   | 7   | 4   | 0   | 0   | 1   | 22  | 7   | 3   | 1   |  |
| x281 | -43 | -11 | -20 | -16 | -1  | -5  | -22 | -13 | -36 | -62 |  |
|      | x6  | x18 | x19 | x20 | x28 | x29 | x31 | x33 | x35 | x50 |  |

|      |      |      |      |      |      |      |      |      |      |      |  |
|------|------|------|------|------|------|------|------|------|------|------|--|
| x76  | 1    |      |      |      |      |      |      |      |      |      |  |
| x80  | 18   | 0    |      |      |      |      |      |      |      |      |  |
| x94  | 4    | 1    | 1    |      |      |      |      |      |      |      |  |
| x95  | 0    | 12   | 0    | 0    |      |      |      |      |      |      |  |
| x96  | 4    | 8    | 2    | 3    | 1    |      |      |      |      |      |  |
| x132 | 13   | 3    | 5    | 10   | 0    | 11   |      |      |      |      |  |
| x133 | 3    | 1    | 1    | 2    | 0    | 2    | 7    |      |      |      |  |
| x134 | 1    | 0    | 0    | 1    | 0    | 1    | 3    | 1    |      |      |  |
| x153 | 64   | 1    | 12   | 4    | 0    | 5    | 15   | 3    | 1    |      |  |
| x167 | 2    | 0    | 1    | 2    | 0    | 2    | 6    | 1    | 0    | 2    |  |
| x173 | 1    | 0    | 1    | 1    | 0    | 1    | 4    | 1    | 0    | 2    |  |
| x175 | 2    | 0    | 1    | 1    | 0    | 2    | 5    | 1    | 0    | 2    |  |
| x176 | 1    | 0    | 0    | 1    | 0    | 1    | 2    | 1    | 0    | 1    |  |
| x177 | 12   | 3    | 5    | 9    | 0    | 10   | 33   | 7    | 3    | 15   |  |
| x178 | 1    | 3    | 0    | 1    | 0    | 2    | 3    | 1    | 0    | 1    |  |
| x179 | 1    | 15   | 0    | 1    | 2    | 8    | 3    | 1    | 0    | 2    |  |
| x181 | 1    | 14   | 0    | 1    | 2    | 7    | 3    | 1    | 0    | 1    |  |
| x218 | 2    | 0    | 1    | 1    | 0    | 2    | 5    | 1    | 0    | 2    |  |
| x222 | 5    | 1    | 2    | 4    | 0    | 4    | 13   | 3    | 1    | 6    |  |
| x281 | -25  | -49  | -31  | -6   | -10  | -13  | -13  | -3   | -58  | -19  |  |
|      | x67  | x76  | x80  | x94  | x95  | x96  | x132 | x133 | x134 | x153 |  |
| x173 | 1    |      |      |      |      |      |      |      |      |      |  |
| x175 | 1    | 1    |      |      |      |      |      |      |      |      |  |
| x176 | 0    | 0    | 0    |      |      |      |      |      |      |      |  |
| x177 | 5    | 4    | 5    | 2    |      |      |      |      |      |      |  |
| x178 | 0    | 0    | 0    | 0    | 3    |      |      |      |      |      |  |
| x179 | 1    | 0    | 1    | 0    | 3    | 3    |      |      |      |      |  |
| x181 | 0    | 0    | 0    | 0    | 3    | 3    | 83   |      |      |      |  |
| x218 | 1    | 1    | 1    | 0    | 7    | 0    | 0    | 0    |      |      |  |
| x222 | 2    | 2    | 2    | 1    | 12   | 1    | 1    | 1    | 2    |      |  |
| x281 | -3   | -2   | -3   | -3   | -13  | -4   | -19  | -17  | -2   | -5   |  |
|      | x167 | x173 | x175 | x176 | x177 | x178 | x179 | x181 | x218 | x222 |  |

## CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 3 measurements and one constraint to determine 4 parameters. The overall fit has a  $\chi^2 = 0.0$  for 0 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients  $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$ , 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.

|       |       |       |       |
|-------|-------|-------|-------|
| $x_2$ | -100  |       |       |
| $x_3$ | -46   | 40    |       |
| $x_4$ | 0     | 0     | 0     |
|       | $x_1$ | $x_2$ | $x_3$ |

## $D^0$ BRANCHING RATIOS

Some older now obsolete results have been omitted from these Listings.

### ———— Topological modes ————

#### $\Gamma(0\text{-prongs})/\Gamma_{\text{total}}$

$\Gamma_1/\Gamma$

This value is obtained by subtracting the branching fractions for 2-, 4-, and 6-prongs from unity.

|                            |                    |
|----------------------------|--------------------|
| <u>VALUE</u>               | <u>DOCUMENT ID</u> |
| <b>0.15 ± 0.06 OUR FIT</b> |                    |

#### $\Gamma(4\text{-prongs})/\Gamma_{\text{total}}$

$\Gamma_3/\Gamma$

This is the sum of our  $K^- 2\pi^+ \pi^-$ ,  $K^- 2\pi^+ \pi^- \pi^0$ ,  $\bar{K}^0 2\pi^+ 2\pi^-$ ,  $K^+ 2K^- \pi^+$ ,  $2\pi^+ 2\pi^-$ ,  $2\pi^+ 2\pi^- \pi^0$ ,  $K^+ K^- \pi^+ \pi^-$ , and  $K^+ K^- \pi^+ \pi^- \pi^0$  branching fractions.

|                              |                    |
|------------------------------|--------------------|
| <u>VALUE</u>                 | <u>DOCUMENT ID</u> |
| <b>0.145 ± 0.005 OUR FIT</b> |                    |
| <b>0.145 ± 0.005</b>         | PDG 12             |

#### $\Gamma(4\text{-prongs})/\Gamma(2\text{-prongs})$

$\Gamma_3/\Gamma_2$

|                              |             |                    |             |   |
|------------------------------|-------------|--------------------|-------------|---|
| <u>VALUE</u>                 | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>  |
| <b>0.207 ± 0.016 OUR FIT</b> |             |                    |             |   |
| <b>0.207 ± 0.016 ± 0.004</b> | 226         | ONENGUT            | 05          | CHRS $\nu_\mu$ emulsion, $\bar{E}_\nu \approx 27$ GeV |

#### $\Gamma(6\text{-prongs})/\Gamma_{\text{total}}$

$\Gamma_4/\Gamma$

This is the sum of our  $K^- 3\pi^+ 2\pi^-$  and  $3\pi^+ 3\pi^-$  branching fractions.

|   |             |                    |             |                |
|---|-------------|--------------------|-------------|----------------|
| <u>VALUE (units <math>10^{-4}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
| <b>6.4 ± 1.3 OUR FIT</b>                  |             |                    |             |                |
| <b>6.4 ± 1.3</b>                          |             | PDG                | 12          |                |

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

|  |   |         |    |   |
|--|---|---------|----|---|
| 12 $\begin{smallmatrix} +13 \\ -9 \end{smallmatrix}$ ± 2 | 3 | ONENGUT | 05 | CHRS $\nu_\mu$ emulsion, $\bar{E}_\nu \approx 27$ GeV |
|--|---|---------|----|---|

————— Inclusive modes —————

 $\Gamma(e^+ \text{ anything})/\Gamma_{\text{total}}$  $\Gamma_5/\Gamma$ 

The branching fractions for the  $K^- e^+ \nu_e$ ,  $K^*(892)^- e^+ \nu_e$ ,  $\pi^- e^+ \nu_e$ , and  $\rho^- e^+ \nu_e$  modes add up to  $6.20 \pm 0.17\%$ .

| <u>VALUE (%)</u>             | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                 |
|------------------------------|-------------|--------------------|-------------|--------------------------------|
| <b>6.49±0.11 OUR AVERAGE</b> |             |                    |             |                                |
| 6.46±0.09±0.11               | 6584 ± 96   | <sup>1</sup> ASNER | 10 CLEO     | $e^+ e^-$ at 3774 MeV          |
| 6.3 ±0.7 ±0.4                | 290 ± 32    | ABLIKIM            | 07G BES2    | $e^+ e^- \approx \psi(3770)$   |
| 6.46±0.17±0.13               | 2246 ± 57   | ADAM               | 06A CLEO    | See ASNER 10                   |
| 6.9 ±0.3 ±0.5                | 1670        | ALBRECHT           | 96C ARG     | $e^+ e^- \approx 10$ GeV       |
| 6.64±0.18±0.29               | 4609        | KUBOTA             | 96B CLE2    | $e^+ e^- \approx \Upsilon(4S)$ |

<sup>1</sup>Using the  $D^+$  and  $D^0$  lifetimes, ASNER 10 finds that the ratio of the  $D^+$  and  $D^0$  semileptonic widths is  $0.985 \pm 0.015 \pm 0.024$ .

 $\Gamma(\mu^+ \text{ anything})/\Gamma_{\text{total}}$  $\Gamma_6/\Gamma$ 

| <u>VALUE (%)</u>           | <u>EVTS</u> | <u>DOCUMENT ID</u>   | <u>TECN</u> | <u>COMMENT</u>               |
|----------------------------|-------------|----------------------|-------------|------------------------------|
| <b>6.7±0.6 OUR FIT</b>     |             |                      |             |                              |
| <b>6.4±0.8 OUR AVERAGE</b> |             |                      |             |                              |
| 6.8±1.5±0.8                | 79 ± 10     | <sup>1</sup> ABLIKIM | 08L BES2    | $e^+ e^- \approx \psi(3772)$ |
| 6.5±1.2±0.3                | 36          | KAYIS-TOPAK.05       | CHRS        | $\nu_\mu$ emulsion           |
| 6.0±0.7±1.2                | 310         | ALBRECHT             | 96C ARG     | $e^+ e^- \approx 10$ GeV     |

<sup>1</sup>ABLIKIM 08L finds the ratio of  $D^+ \rightarrow \mu^+ X$  and  $D^0 \rightarrow \mu^+ X$  branching fractions to be  $2.59 \pm 0.70 \pm 0.25$ , in accord with the ratio of  $D^+$  and  $D^0$  lifetimes,  $2.54 \pm 0.02$ .

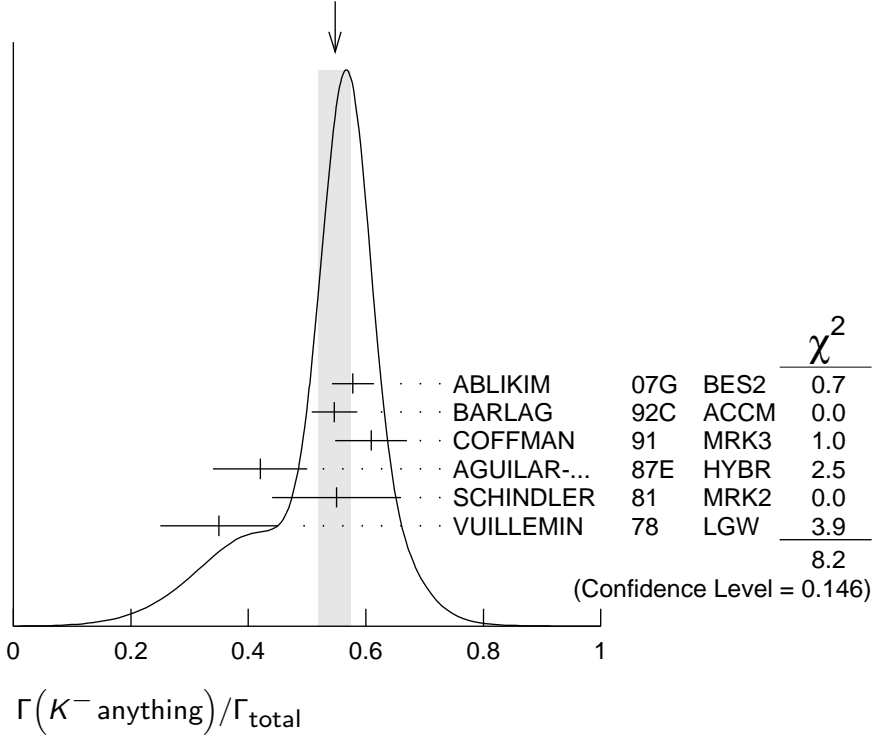
 $\Gamma(K^- \text{ anything})/\Gamma_{\text{total}}$  $\Gamma_7/\Gamma$ 

| <u>VALUE</u>   | <u>EVTS</u> | <u>DOCUMENT ID</u>  | <u>TECN</u> | <u>COMMENT</u>               |
|--|-------------|---------------------|-------------|------------------------------|
| <b>0.547±0.028 OUR AVERAGE</b> Error includes scale factor of 1.3. See the ideogram below. |             |                     |             |                              |
| 0.578±0.016±0.032  | 2098 ± 59   | ABLIKIM             | 07G BES2    | $e^+ e^- \approx \psi(3770)$ |
| 0.546 <sup>+0.039</sup> <sub>-0.038</sub>  |             | <sup>1</sup> BARLAG | 92C ACCM    | $\pi^-$ Cu 230 GeV           |
| 0.609±0.032±0.052  |             | COFFMAN             | 91 MRK3     | $e^+ e^-$ 3.77 GeV           |
| 0.42 ±0.08   |             | AGUILAR-...         | 87E HYBR    | $\pi p$ , $pp$ 360, 400 GeV  |
| 0.55 ±0.11   | 121         | SCHINDLER           | 81 MRK2     | $e^+ e^-$ 3.771 GeV          |
| 0.35 ±0.10   | 19          | VUILLEMIN           | 78 LGW      | $e^+ e^-$ 3.772 GeV          |

<sup>1</sup>BARLAG 92C computes the branching fraction using topological normalization.



WEIGHTED AVERAGE  
 $0.547 \pm 0.028$  (Error scaled by 1.3)



**$[\Gamma(\bar{K}^0 \text{ anything}) + \Gamma(K^0 \text{ anything})] / \Gamma_{\text{total}}$**   **$\Gamma_8 / \Gamma$**

| VALUE                             | EVTS               | DOCUMENT ID | TECN     | COMMENT               |
|-----------------------------------|--------------------|-------------|----------|-----------------------|
| <b><math>0.47 \pm 0.04</math></b> | <b>OUR AVERAGE</b> |             |          |                       |
| $0.476 \pm 0.048 \pm 0.030$       | $250 \pm 25$       | ABLIKIM     | 06U BES2 | $e^+ e^-$ at 3773 MeV |
| $0.455 \pm 0.050 \pm 0.032$       |                    | COFFMAN     | 91 MRK3  | $e^+ e^-$ 3.77 GeV    |

**$\Gamma(K^+ \text{ anything}) / \Gamma_{\text{total}}$**   **$\Gamma_9 / \Gamma$**

| VALUE                               | EVTS               | DOCUMENT ID         | TECN     | COMMENT                      |
|-------------------------------------|--------------------|---------------------|----------|------------------------------|
| <b><math>0.034 \pm 0.004</math></b> | <b>OUR AVERAGE</b> |                     |          |                              |
| $0.035 \pm 0.007 \pm 0.003$         | $119 \pm 23$       | ABLIKIM             | 07G BES2 | $e^+ e^- \approx \psi(3770)$ |
| $0.034^{+0.007}_{-0.005}$           |                    | <sup>1</sup> BARLAG | 92C ACCM | $\pi^-$ Cu 230 GeV           |
| $0.028 \pm 0.009 \pm 0.004$         |                    | COFFMAN             | 91 MRK3  | $e^+ e^-$ 3.77 GeV           |
| $0.03^{+0.05}_{-0.02}$              |                    | AGUILAR-...         | 87E HYBR | $\pi p, pp$ 360, 400 GeV     |
| $0.08 \pm 0.03$                     | 25                 | SCHINDLER           | 81 MRK2  | $e^+ e^-$ 3.771 GeV          |

<sup>1</sup> BARLAG 92C computes the branching fraction using topological normalization.

**$\Gamma(K^*(892)^- \text{ anything}) / \Gamma_{\text{total}}$**   **$\Gamma_{10} / \Gamma$**

| VALUE   | EVTS        | DOCUMENT ID | TECN     | COMMENT               |
|---|-------------|-------------|----------|-----------------------|
| <b><math>0.153 \pm 0.083 \pm 0.019</math></b> | $28 \pm 15$ | ABLIKIM     | 06U BES2 | $e^+ e^-$ at 3773 MeV |

**$\Gamma(\bar{K}^*(892)^0 \text{ anything}) / \Gamma_{\text{total}}$**   **$\Gamma_{11} / \Gamma$**

| VALUE   | EVTS        | DOCUMENT ID | TECN    | COMMENT                    |
|---|-------------|-------------|---------|----------------------------|
| <b><math>0.087 \pm 0.040 \pm 0.012</math></b> | $96 \pm 44$ | ABLIKIM     | 05P BES | $e^+ e^- \approx 3773$ MeV |

$\Gamma(K^*(892)^+ \text{ anything})/\Gamma_{\text{total}}$   $\Gamma_{12}/\Gamma$

| VALUE  | CL% | DOCUMENT ID | TECN     | COMMENT              |
|--------|-----|-------------|----------|----------------------|
| <0.036 | 90  | ABLIKIM     | 06U BES2 | $e^+e^-$ at 3773 MeV |

$\Gamma(K^*(892)^0 \text{ anything})/\Gamma_{\text{total}}$   $\Gamma_{13}/\Gamma$

| VALUE                       | EVTS        | DOCUMENT ID | TECN    | COMMENT                   |
|-----------------------------|-------------|-------------|---------|---------------------------|
| $0.028 \pm 0.012 \pm 0.004$ | $31 \pm 12$ | ABLIKIM     | 05P BES | $e^+e^- \approx 3773$ MeV |

$\Gamma(\eta \text{ anything})/\Gamma_{\text{total}}$   $\Gamma_{14}/\Gamma$

This ratio includes  $\eta'$  particles from  $\eta'$  decays.

| VALUE (units $10^{-2}$ ) | EVTS           | DOCUMENT ID | TECN     | COMMENT                  |
|--------------------------|----------------|-------------|----------|--------------------------|
| $9.5 \pm 0.4 \pm 0.8$    | $4463 \pm 197$ | HUANG       | 06B CLEO | $e^+e^-$ at $\psi(3770)$ |

$\Gamma(\eta' \text{ anything})/\Gamma_{\text{total}}$   $\Gamma_{15}/\Gamma$

| VALUE (units $10^{-2}$ ) | EVTS         | DOCUMENT ID | TECN     | COMMENT                  |
|--------------------------|--------------|-------------|----------|--------------------------|
| $2.48 \pm 0.17 \pm 0.21$ | $299 \pm 21$ | HUANG       | 06B CLEO | $e^+e^-$ at $\psi(3770)$ |

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$   $\Gamma_{16}/\Gamma$

| VALUE (units $10^{-2}$ ) | EVTS         | DOCUMENT ID | TECN     | COMMENT                  |
|--------------------------|--------------|-------------|----------|--------------------------|
| $1.05 \pm 0.08 \pm 0.07$ | $368 \pm 24$ | HUANG       | 06B CLEO | $e^+e^-$ at $\psi(3770)$ |

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

|                                 |   |     |         |   |
|---------------------------------|---|-----|---------|---|
| $1.71^{+0.76}_{-0.71} \pm 0.17$ | 9 | BAI | 00C BES | $e^+e^- \rightarrow D\bar{D}^*, D^*\bar{D}^*$ |
|---------------------------------|---|-----|---------|---|

————— Semileptonic modes —————

$\Gamma(K^- e^+ \nu_e)/\Gamma_{\text{total}}$   $\Gamma_{18}/\Gamma$

| VALUE (units $10^{-2}$ )    | EVTS                                | DOCUMENT ID | TECN | COMMENT |
|-----------------------------|-------------------------------------|-------------|------|---------|
| $3.57 \pm 0.06$ OUR FIT     | Error includes scale factor of 1.5. |             |      |         |
| $3.50 \pm 0.05$ OUR AVERAGE |                                     |             |      |         |

|                          |               |                      |         |                               |
|--------------------------|---------------|----------------------|---------|-------------------------------|
| $3.50 \pm 0.03 \pm 0.04$ | 14.1k         | <sup>1</sup> BESSON  | 09 CLEO | $e^+e^-$ at $\psi(3770)$      |
| $3.45 \pm 0.10 \pm 0.19$ | $1318 \pm 38$ | <sup>2</sup> WIDHALM | 06 BELL | $e^+e^- \approx \Upsilon(4S)$ |
| $3.82 \pm 0.40 \pm 0.27$ | $104 \pm 11$  | ABLIKIM              | 04C BES | $e^+e^-$ , 3.773 GeV          |
| $3.4 \pm 0.5 \pm 0.4$    | 55            | ADLER                | 89 MRK3 | $e^+e^-$ 3.77 GeV             |

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

|                          |               |                    |         |               |
|--------------------------|---------------|--------------------|---------|---------------|
| $3.56 \pm 0.03 \pm 0.09$ |               | <sup>3</sup> DOBBS | 08 CLEO | See BESSON 09 |
| $3.44 \pm 0.10 \pm 0.10$ | $1311 \pm 37$ | COAN               | 05 CLEO | See DOBBS 08  |

<sup>1</sup> See the form-factor parameters near the end of this  $D^0$  Listing.

<sup>2</sup> The  $\pi^- e^+ \nu_e$  and  $K^- e^+ \nu_e$  results of WIDHALM 06 give  $|\frac{V_{cd}}{V_{cs}} \cdot \frac{f_+^{\pi}(0)}{f_+^K(0)}|^2 = 0.042 \pm 0.003 \pm 0.003$ .

<sup>3</sup> DOBBS 08 establishes  $|\frac{V_{cd}}{V_{cs}} \cdot \frac{f_+^{\pi}(0)}{f_+^K(0)}| = 0.188 \pm 0.008 \pm 0.002$  from the  $D^+$  and  $D^0$  decays to  $\bar{K} e^+ \nu_e$  and  $\pi e^+ \nu_e$ .

$\Gamma(K^- e^+ \nu_e)/\Gamma(K^- \pi^+)$   $\Gamma_{18}/\Gamma_{31}$

| <u>VALUE</u>   | <u>EVTS</u> | <u>DOCUMENT ID</u>    | <u>TECN</u> | <u>COMMENT</u>                |
|--|-------------|-----------------------|-------------|-------------------------------|
| <b>0.908±0.015 OUR FIT</b> Error includes scale factor of 1.5. |             |                       |             |                               |
| <b>0.930±0.013 OUR AVERAGE</b>                                 |             |                       |             |                               |
| 0.927±0.007±0.012  | 76k±323     | <sup>1</sup> AUBERT   | 07BG BABR   | $e^+e^- \approx \Upsilon(4S)$ |
| 0.978±0.027±0.044  | 2510        | <sup>2</sup> BEAN     | 93C CLE2    | $e^+e^- \approx \Upsilon(4S)$ |
| 0.90 ±0.06 ±0.06   | 584         | <sup>3</sup> CRAWFORD | 91B CLEO    | $e^+e^- \approx 10.5$ GeV     |
| 0.91 ±0.07 ±0.11   | 250         | <sup>4</sup> ANJOS    | 89F E691    | Photoproduction               |

<sup>1</sup> The event samples in this AUBERT 07BG result include radiative photons. The  $D^0 \rightarrow K^- e^+ \nu_e$  form factor at  $q^2 = 0$  is  $f_+(0) = 0.727 \pm 0.007 \pm 0.005 \pm 0.007$ .

<sup>2</sup> BEAN 93C uses  $K^- \mu^+ \nu_\mu$  as well as  $K^- e^+ \nu_e$  events and makes a small phase-space adjustment to the number of the  $\mu^+$  events to use them as  $e^+$  events. A pole mass of  $2.00 \pm 0.12 \pm 0.18$  GeV/ $c^2$  is obtained from the  $q^2$  dependence of the decay rate.

<sup>3</sup> CRAWFORD 91B uses  $K^- e^+ \nu_e$  and  $K^- \mu^+ \nu_\mu$  candidates to measure a pole mass of  $2.1^{+0.4+0.3}_{-0.2-0.2}$  GeV/ $c^2$  from the  $q^2$  dependence of the decay rate.

<sup>4</sup> ANJOS 89F measures a pole mass of  $2.1^{+0.4}_{-0.2} \pm 0.2$  GeV/ $c^2$  from the  $q^2$  dependence of the decay rate.

$\Gamma(K^- \mu^+ \nu_\mu)/\Gamma_{\text{total}}$   $\Gamma_{19}/\Gamma$

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                |
|---|-------------|--------------------|-------------|-------------------------------|
| <b>3.33±0.13 OUR FIT</b>                  |             |                    |             |                               |
| <b>3.45±0.10±0.21</b>                     | 1249 ± 43   | WIDHALM            | 06 BELL     | $e^+e^- \approx \Upsilon(4S)$ |

$\Gamma(K^- \mu^+ \nu_\mu)/\Gamma(K^- \pi^+)$   $\Gamma_{19}/\Gamma_{31}$

| <u>VALUE</u>                  | <u>EVTS</u> | <u>DOCUMENT ID</u>    | <u>TECN</u> | <u>COMMENT</u>                         |
|-------------------------------|-------------|-----------------------|-------------|--|
| <b>0.848±0.033 OUR FIT</b>    |             |                       |             |  |
| <b>0.84 ±0.04 OUR AVERAGE</b> |             |                       |             |  |
| 0.852±0.034±0.028             | 1897        | <sup>1</sup> FRABETTI | 95G E687    | $\gamma$ Be $\bar{E}_\gamma = 220$ GeV |
| 0.82 ±0.13 ±0.13              | 338         | <sup>2</sup> FRABETTI | 93I E687    | $\gamma$ Be $\bar{E}_\gamma = 221$ GeV |
| 0.79 ±0.08 ±0.09              | 231         | <sup>3</sup> CRAWFORD | 91B CLEO    | $e^+e^- \approx 10.5$ GeV              |

<sup>1</sup> FRABETTI 95G extracts the ratio of form factors  $f_-(0)/f_+(0) = -1.3^{+3.6}_{-3.4} \pm 0.6$ , and measures a pole mass of  $1.87^{+0.11+0.07}_{-0.08-0.06}$  GeV/ $c^2$  from the  $q^2$  dependence of the decay rate.

<sup>2</sup> FRABETTI 93I measures a pole mass of  $2.1^{+0.7+0.7}_{-0.3-0.3}$  GeV/ $c^2$  from the  $q^2$  dependence of the decay rate.

<sup>3</sup> CRAWFORD 91B measures a pole mass of  $2.00 \pm 0.12 \pm 0.18$  GeV/ $c^2$  from the  $q^2$  dependence of the decay rate.

$\Gamma(K^- \mu^+ \nu_\mu)/\Gamma(\mu^+ \text{anything})$   $\Gamma_{19}/\Gamma_6$

| <u>VALUE</u>  | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|---|-------------|--------------------|-------------|--------------------------|
| <b>0.50 ±0.05 OUR FIT</b>   |             |                    |             |                          |
| <b>0.472±0.051±0.040</b>  | 232         | KODAMA             | 94 E653     | $\pi^-$ emulsion 600 GeV |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |                    |             |                          |
| 0.32 ±0.05 ±0.05  | 124         | KODAMA             | 91 EMUL     | $pA$ 800 GeV             |

$\Gamma(K^- \pi^0 e^+ \nu_e) / \Gamma_{\text{total}}$   $\Gamma_{22} / \Gamma$

| VALUE                               | EVTS | DOCUMENT ID      | TECN | COMMENT                         |
|-------------------------------------|------|------------------|------|---------------------------------|
| $0.016^{+0.013}_{-0.005} \pm 0.002$ | 4    | <sup>1</sup> BAI | 91   | MRK3 $e^+ e^- \approx 3.77$ GeV |

<sup>1</sup>BAI 91 finds that a fraction  $0.79^{+0.15+0.09}_{-0.17-0.03}$  of combined  $D^+$  and  $D^0$  decays to  $\bar{K} \pi e^+ \nu_e$  (24 events) are  $\bar{K}^*(892) e^+ \nu_e$ . BAI 91 uses 56  $K^- e^+ \nu_e$  events to measure a pole mass of  $1.8 \pm 0.3 \pm 0.2$  GeV/ $c^2$  from the  $q^2$  dependence of the decay rate.

$\Gamma(\bar{K}^0 \pi^- e^+ \nu_e) / \Gamma_{\text{total}}$   $\Gamma_{23} / \Gamma$

| VALUE (units $10^{-2}$ )                           | EVTS | DOCUMENT ID | TECN | COMMENT |
|--|------|-------------|------|---------|
| <b>2.7 <math>^{+0.9}_{-0.7}</math> OUR AVERAGE</b> |      |             |      |         |

2.61  $\pm 1.04 \pm 0.28$       9  $\pm 3$       ABLIKIM      06O BES2       $e^+ e^-$  at 3773 MeV

2.8  $^{+1.7}_{-0.8} \pm 0.3$       6      <sup>1</sup>BAI      91      MRK3       $e^+ e^- \approx 3.77$  GeV

<sup>1</sup>BAI 91 finds that a fraction  $0.79^{+0.15+0.09}_{-0.17-0.03}$  of combined  $D^+$  and  $D^0$  decays to  $\bar{K} \pi e^+ \nu_e$  (24 events) are  $\bar{K}^*(892) e^+ \nu_e$ .

$\Gamma(K^*(892)^- e^+ \nu_e) / \Gamma_{\text{total}}$   $\Gamma_{20} / \Gamma$

Both decay modes of the  $K^*(892)^-$  are included.

| VALUE (units $10^{-2}$ )                  | EVTS | DOCUMENT ID | TECN | COMMENT |
|---|------|-------------|------|---------|
| <b>2.16 <math>\pm 0.16</math> OUR FIT</b> |      |             |      |         |

**2.16  $\pm 0.15 \pm 0.08$**       219  $\pm 16$       <sup>1</sup>COAN      05      CLEO       $e^+ e^-$  at  $\psi(3770)$

<sup>1</sup>COAN 05 uses both  $K^- \pi^0$  and  $K_S^0 \pi^-$  events.

$\Gamma(K^*(892)^- e^+ \nu_e) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{20} / \Gamma_{35}$

Unseen decay modes of the  $K^*(892)^-$  are included.

| VALUE                                     | EVTS | DOCUMENT ID | TECN | COMMENT |
|---|------|-------------|------|---------|
| <b>0.76 <math>\pm 0.07</math> OUR FIT</b> |      |             |      |         |

**0.76  $\pm 0.12 \pm 0.06$**       152      <sup>1</sup>BEAN      93C      CLE2       $e^+ e^- \approx \Upsilon(4S)$

<sup>1</sup>BEAN 93C uses  $K^{*-} \mu^+ \nu_\mu$  as well as  $K^{*-} e^+ \nu_e$  events and makes a small phase-space adjustment to the number of the  $\mu^+$  events to use them as  $e^+$  events.

$\Gamma(K^*(892)^- \mu^+ \nu_\mu) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{21} / \Gamma_{35}$

Unseen decay modes of the  $K^*(892)^-$  are included.

| VALUE   | EVTS         | DOCUMENT ID       | TECN | COMMENT   |
|---|--------------|-------------------|------|---|
| <b>0.674 <math>\pm 0.068 \pm 0.026</math></b> | 175 $\pm 17$ | <sup>1</sup> LINK | 05B  | FOCS $\gamma$ A, $\bar{E}_\gamma \approx 180$ GeV |

<sup>1</sup>LINK 05B finds that in  $D^0 \rightarrow \bar{K}^0 \pi^- \mu^+ \nu_\mu$  the  $\bar{K}^0 \pi^-$  system is 6% in S-wave.

$\Gamma(K^- \pi^+ \pi^- e^+ \nu_e) / \Gamma_{\text{total}}$   $\Gamma_{24} / \Gamma$

| VALUE (units $10^{-4}$ )                       | EVTS | DOCUMENT ID | TECN | COMMENT                            |
|--|------|-------------|------|------------------------------------|
| <b>2.8 <math>^{+1.4}_{-1.1} \pm 0.3</math></b> | 8    | ARTUSO      | 07A  | CLEO $e^+ e^-$ at $\Upsilon(3770)$ |

$\Gamma(K_1(1270)^- e^+ \nu_e) / \Gamma_{\text{total}}$   $\Gamma_{25} / \Gamma$

| VALUE (units $10^{-4}$ )    | EVTS | DOCUMENT ID         | TECN | COMMENT                            |
|-----------------------------|------|---------------------|------|------------------------------------|
| $7.6^{+4.1}_{-3.0} \pm 0.9$ | 8    | <sup>1</sup> ARTUSO | 07A  | CLEO $e^+ e^-$ at $\Upsilon(3770)$ |

<sup>1</sup> This ARTUSO 07A result is corrected for all decay modes of the  $K_1(1270)^-$ .

$\Gamma(K^- \pi^+ \pi^- \mu^+ \nu_\mu) / \Gamma(K^- \mu^+ \nu_\mu)$   $\Gamma_{26} / \Gamma_{19}$

| VALUE            | CL% | DOCUMENT ID | TECN | COMMENT                       |
|------------------|-----|-------------|------|-------------------------------|
| <b>&lt;0.037</b> | 90  | KODAMA      | 93B  | E653 $\pi^-$ emulsion 600 GeV |

$\Gamma((\bar{K}^*(892)\pi)^- \mu^+ \nu_\mu) / \Gamma(K^- \mu^+ \nu_\mu)$   $\Gamma_{27} / \Gamma_{19}$

| VALUE            | CL% | DOCUMENT ID         | TECN | COMMENT                       |
|------------------|-----|---------------------|------|-------------------------------|
| <b>&lt;0.043</b> | 90  | <sup>1</sup> KODAMA | 93B  | E653 $\pi^-$ emulsion 600 GeV |

<sup>1</sup> KODAMA 93B searched in  $K^- \pi^+ \pi^- \mu^+ \nu_\mu$ , but the limit includes other  $(\bar{K}^*(892)\pi)^-$  charge states.

$\Gamma(\pi^- e^+ \nu_e) / \Gamma_{\text{total}}$   $\Gamma_{28} / \Gamma$

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

**0.289 ± 0.008 OUR FIT**

**0.287 ± 0.008 OUR AVERAGE**

0.288 ± 0.008 ± 0.003    1374    <sup>1</sup> BESSON    09    CLEO     $e^+ e^-$  at  $\psi(3770)$

0.279 ± 0.027 ± 0.016    126 ± 12    <sup>2</sup> WIDHALM    06    BELL     $e^+ e^- \approx \Upsilon(4S)$

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

0.299 ± 0.011 ± 0.009    <sup>3</sup> DOBBS    08    CLEO    See BESSON 09

0.262 ± 0.025 ± 0.008    117 ± 11    COAN    05    CLEO    See DOBBS 08

<sup>1</sup> See the form-factor parameters near the end of this  $D^0$  Listing.

<sup>2</sup> The  $\pi^- e^+ \nu_e$  and  $K^- e^+ \nu_e$  results of WIDHALM 06 give  $|\frac{V_{cd}}{V_{cs}} \cdot \frac{f_+^\pi(0)}{f_+^K(0)}|^2 = 0.042 \pm 0.003 \pm 0.003$ .

<sup>3</sup> DOBBS 08 establishes  $|\frac{V_{cd}}{V_{cs}} \cdot \frac{f_+^\pi(0)}{f_+^K(0)}| = 0.188 \pm 0.008 \pm 0.002$  from the  $D^+$  and  $D^0$  decays to  $\bar{K} e^+ \nu_e$  and  $\pi e^+ \nu_e$ .

$\Gamma(\pi^- e^+ \nu_e) / \Gamma(K^- e^+ \nu_e)$   $\Gamma_{28} / \Gamma_{18}$

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

**0.0809 ± 0.0027 OUR FIT** Error includes scale factor of 1.1.

**0.085 ± 0.007 OUR AVERAGE**

0.082 ± 0.006 ± 0.005    <sup>1</sup> HUANG    05    CLEO     $e^+ e^- \approx \Upsilon(4S)$

0.101 ± 0.020 ± 0.003    91    <sup>2</sup> FRABETTI    96B    E687     $\gamma$  Be,  $\bar{E}_\gamma \approx 200$  GeV

0.103 ± 0.039 ± 0.013    87    <sup>3</sup> BUTLER    95    CLE2    < 0.156 (90% CL)

<sup>1</sup> HUANG 05 uses both  $e$  and  $\mu$  events, and makes a small correction to the  $\mu$  events to make them effectively  $e$  events. This result gives  $|\frac{V_{cd}}{V_{cs}} \cdot \frac{f_+^\pi(0)}{f_+^K(0)}|^2 = 0.038^{+0.006+0.005}_{-0.007-0.003}$ .

<sup>2</sup> FRABETTI 96B uses both  $e$  and  $\mu$  events, and makes a small correction to the  $\mu$  events to make them effectively  $e$  events. This result gives  $|\frac{V_{cd}}{V_{cs}} \cdot \frac{f_+^\pi(0)}{f_+^K(0)}|^2 = 0.050 \pm 0.011 \pm 0.002$ .

<sup>3</sup> BUTLER 95 has  $87 \pm 33 \pi^- e^+ \nu_e$  events. The result gives  $|\frac{V_{cd}}{V_{cs}} \cdot \frac{f_+^\pi(0)}{f_+^K(0)}|^2 = 0.052 \pm 0.020 \pm 0.007$ .

$\Gamma(\pi^- \mu^+ \nu_\mu) / \Gamma_{\text{total}}$   $\Gamma_{29} / \Gamma$

| VALUE (units $10^{-2}$ )     | EVTS     | DOCUMENT ID | TECN    | COMMENT                        |
|------------------------------|----------|-------------|---------|--------------------------------|
| <b>0.238 ± 0.024 OUR FIT</b> |          |             |         |                                |
| <b>0.231 ± 0.026 ± 0.019</b> | 106 ± 13 | WIDHALM     | 06 BELL | $e^+ e^- \approx \Upsilon(4S)$ |

$\Gamma(\pi^- \mu^+ \nu_\mu) / \Gamma(K^- \mu^+ \nu_\mu)$   $\Gamma_{29} / \Gamma_{19}$

| VALUE                        | EVTS     | DOCUMENT ID       | TECN    | COMMENT  |
|------------------------------|----------|-------------------|---------|--|
| <b>0.071 ± 0.007 OUR FIT</b> |          |                   |         |  |
| <b>0.074 ± 0.008 ± 0.007</b> | 288 ± 29 | <sup>1</sup> LINK | 05 FOCS | $\gamma A, \bar{E}_\gamma \approx 180 \text{ GeV}$ |

<sup>1</sup> LINK 05 finds the form-factor ratio  $|f_0^\pi(0) / f_0^K(0)|$  to be  $0.85 \pm 0.04 \pm 0.04 \pm 0.01$ .

$\Gamma(\rho^- e^+ \nu_e) / \Gamma_{\text{total}}$   $\Gamma_{30} / \Gamma$

| VALUE (units $10^{-3}$ )  | EVTS     | DOCUMENT ID          | TECN    | COMMENT                   |
|---------------------------|----------|----------------------|---------|---------------------------|
| <b>1.77 ± 0.12 ± 0.10</b> | 305 ± 21 | <sup>1,2</sup> DOBBS | 13 CLEO | $e^+ e^-$ at $\psi(3770)$ |

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

1.94 ± 0.39 ± 0.13      31 ± 6      COAN      05 CLEO      See DOBBS 13

<sup>1</sup> DOBBS 13 finds  $\Gamma(D^0 \rightarrow \rho^- e^+ \nu_e) / 2 \Gamma(D^+ \rightarrow \rho^0 e^+ \nu_e) = 1.03 \pm 0.09^{+0.08}_{-0.02}$ ; isospin invariance predicts the ratio is 1.0.

<sup>2</sup> See the  $D^+$  Listings for  $D \rightarrow \rho e^+ \nu_e$  form factors.

————— Hadronic modes with a single  $\bar{K}$  —————

$\Gamma(K^- \pi^+) / \Gamma_{\text{total}}$   $\Gamma_{31} / \Gamma$

| VALUE (units $10^{-2}$ )       | EVTS | DOCUMENT ID | TECN | COMMENT                             |
|--------------------------------|------|-------------|------|-------------------------------------|
| <b>3.93 ± 0.04 OUR FIT</b>     |      |             |      | Error includes scale factor of 1.1. |
| <b>3.93 ± 0.05 OUR AVERAGE</b> |      |             |      | Error includes scale factor of 1.1. |

3.934 ± 0.021 ± 0.061      BONVICINI      14 CLEO      All CLEO-c runs

4.007 ± 0.037 ± 0.072      33.8k      AUBERT      08L BABR       $e^+ e^-$  at  $\Upsilon(4S)$

3.82 ± 0.07 ± 0.12      <sup>1</sup> ARTUSO      98 CLE2      CLEO average

3.90 ± 0.09 ± 0.12      5.4k      <sup>2</sup> BARATE      97C ALEP      From Z decays

3.41 ± 0.12 ± 0.28      1.2k      <sup>2</sup> ALBRECHT      94F ARG       $e^+ e^- \approx \Upsilon(4S)$

3.62 ± 0.34 ± 0.44      <sup>2</sup> DECAMP      91J ALEP      From Z decays

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

3.891 ± 0.035 ± 0.069      <sup>3</sup> DOBBS      07 CLEO      See BONVICINI 14

3.91 ± 0.08 ± 0.09      10.3k      <sup>3</sup> HE      05 CLEO      See DOBBS 07

3.81 ± 0.15 ± 0.16      1.2k      <sup>4</sup> ARTUSO      98 CLE2       $e^+ e^-$  at  $\Upsilon(4S)$

3.69 ± 0.11 ± 0.16      <sup>5</sup> COAN      98 CLE2      See ARTUSO 98

4.5 ± 0.6 ± 0.4      <sup>6</sup> ALBRECHT      94 ARG       $e^+ e^- \approx \Upsilon(4S)$

3.95 ± 0.08 ± 0.17      4.2k      <sup>2,7</sup> AKERIB      93 CLE2      See ARTUSO 98

4.5 ± 0.8 ± 0.5      56      <sup>2</sup> ABACHI      88 HRS       $e^+ e^-$  29 GeV

4.2 ± 0.4 ± 0.4      0.9k      ADLER      88C MRK3       $e^+ e^-$  3.77 GeV

4.1 ± 0.6      0.3k      <sup>8</sup> SCHINDLER      81 MRK2       $e^+ e^-$  3.771 GeV

4.3 ± 1.0      130      <sup>9</sup> PERUZZI      77 LGW       $e^+ e^-$  3.77 GeV

- <sup>1</sup> This combines the CLEO results of ARTUSO 98, COAN 98, and AKERIB 93.  
<sup>2</sup> ABACHI 88, DECAMP 91J, AKERIB 93, ALBRECHT 94F, and BARATE 97C use  $D^*(2010)^+ \rightarrow D^0 \pi^+$  decays. The  $\pi^+$  is both slow and of low  $p_T$  with respect to the event thrust axis or nearest jet ( $\approx D^{*+}$  direction). The excess number of such  $\pi^+$ 's over background gives the number of  $D^*(2010)^+ \rightarrow D^0 \pi^+$  events, and the fraction with  $D^0 \rightarrow K^- \pi^+$  gives the  $D^0 \rightarrow K^- \pi^+$  branching fraction.  
<sup>3</sup> DOBBS 07 and HE 05 use single- and double-tagged events in an overall fit. DOBBS 07 supersedes HE 05.  
<sup>4</sup> ARTUSO 98, following ALBRECHT 94, uses  $D^0$  mesons from  $\bar{B}^0 \rightarrow D^*(2010)^+ X \ell^- \bar{\nu}_\ell$  decays. Our average uses the CLEO average of this value with the values of COAN 98 and AKERIB 93.  
<sup>5</sup> COAN 98 assumes that  $\Gamma(B \rightarrow \bar{D} X \ell^+ \nu)/\Gamma(B \rightarrow X \ell^+ \nu) = 1.0 - 3|V_{ub}/V_{cb}|^2 - 0.010 \pm 0.005$ , the last term accounting for  $\bar{B} \rightarrow D_s^+ K X \ell^- \bar{\nu}$ . COAN 98 is included in the CLEO average in ARTUSO 98.  
<sup>6</sup> ALBRECHT 94 uses  $D^0$  mesons from  $\bar{B}^0 \rightarrow D^{*+} \ell^- \bar{\nu}_\ell$  decays. This is a different set of events than used by ALBRECHT 94F.  
<sup>7</sup> This AKERIB 93 value includes radiative corrections; without them, the value is  $0.0391 \pm 0.0008 \pm 0.0017$ . AKERIB 93 is included in the CLEO average in ARTUSO 98.  
<sup>8</sup> SCHINDLER 81 (MARK-2) measures  $\sigma(e^+ e^- \rightarrow \psi(3770)) \times$  branching fraction to be  $0.24 \pm 0.02$  nb. We use the MARK-3 (ADLER 88C) value of  $\sigma = 5.8 \pm 0.5 \pm 0.6$  nb.  
<sup>9</sup> PERUZZI 77 (MARK-1) measures  $\sigma(e^+ e^- \rightarrow \psi(3770)) \times$  branching fraction to be  $0.25 \pm 0.05$  nb. We use the MARK-3 (ADLER 88C) value of  $\sigma = 5.8 \pm 0.5 \pm 0.6$  nb.

$\Gamma(K^+ \pi^-)/\Gamma(K^- \pi^+)$   $\Gamma_{32}/\Gamma_{31}$

| <u>VALUE (units <math>10^{-3}</math>)</u>   | <u>DOCUMENT ID</u>    | <u>TECN</u> | <u>COMMENT</u>                          |
|---|-----------------------|-------------|---|
| <b>3.56 <math>\pm</math> 0.06 OUR AVERAGE</b>   |                       |             |   |
| 3.53 $\pm$ 0.13   | <sup>1</sup> KO       | 14          | BELL $e^+ e^- \rightarrow \Upsilon(nS)$ |
| 3.568 $\pm$ 0.066   | <sup>2</sup> AAIJ     | 13CE        | LHCB $pp$ at 7, 8 TeV                   |
| 3.51 $\pm$ 0.35   | <sup>3</sup> AALTONEN | 13AE        | CDF $p\bar{p}$ at 1.96 TeV              |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●   |                       |             |   |
| 3.52 $\pm$ 0.15   | <sup>4</sup> AAIJ     | 13N         | LHCB Repl. by AAIJ 13CE                 |
| <sup>1</sup> Based on $976 \text{ fb}^{-1}$ of data collected at $Y(nS)$ resonances. Assumes no $CP$ violation.               |                       |             |   |
| <sup>2</sup> Based on $3 \text{ fb}^{-1}$ of data collected at $\sqrt{s} = 7, 8 \text{ TeV}$ . Assumes no $CP$ violation.     |                       |             |   |
| <sup>3</sup> Based on $9.6 \text{ fb}^{-1}$ of data collected at the Tevatron. Assumes no $CP$ violation.                     |                       |             |   |
| <sup>4</sup> Based on $1 \text{ fb}^{-1}$ of data collected at $\sqrt{s} = 7 \text{ TeV}$ in 2011. Assumes no $CP$ violation. |                       |             |   |

$\Gamma(K_S^0 \pi^0)/\Gamma_{\text{total}}$   $\Gamma_{33}/\Gamma$

| <u>VALUE (units <math>10^{-2}</math>)</u>                                     | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>     |
|---|-------------|--------------------|-------------|--------------------|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |             |                    |             |                    |
| 1.240 $\pm$ 0.017 $\pm$ 0.056   | 614         | HE                 | 08          | CLEO See MENDEZ 10 |

$\Gamma(K_S^0 \pi^0)/\Gamma(K^- \pi^+)$   $\Gamma_{33}/\Gamma_{31}$

| <u>VALUE</u>  | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>              |
|---|-------------|--------------------|-------------|-----------------------------|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |             |                    |             |                             |
| 0.68 $\pm$ 0.12 $\pm$ 0.11  | 119         | ANJOS              | 92B         | E691 $\gamma$ Be 80–240 GeV |

$\Gamma(K_S^0 \pi^0)/[\Gamma(K^- \pi^+) + \Gamma(K^+ \pi^-)]$   $\Gamma_{33}/(\Gamma_{31} + \Gamma_{222})$

| <u>VALUE (units <math>10^{-2}</math>)</u>             | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>             |
|---|-------------|--------------------|-------------|----------------------------|
| <b>30.5 <math>\pm</math> 0.9 OUR FIT</b>              |             |                    |             |                            |
| <b>30.4 <math>\pm</math> 0.3 <math>\pm</math> 0.9</b> | 20k         | MENDEZ             | 10          | CLEO $e^+ e^-$ at 3774 MeV |

$\Gamma(K_S^0 \pi^0)/\Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{33}/\Gamma_{35}$

| VALUE   | EVTS      | DOCUMENT ID           | TECN     | COMMENT                  |
|---|-----------|-----------------------|----------|--------------------------|
| <b>0.421 ± 0.029 OUR FIT</b>  |           |                       |          |                          |
| <b>0.44 ± 0.02 ± 0.05</b>   | 1942 ± 64 | PROCARIO              | 93B CLE2 | $e^+ e^-$ 10.36–10.7 GeV |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |           |                       |          |                          |
| 0.34 ± 0.04 ± 0.02  | 92        | <sup>1</sup> ALBRECHT | 92P ARG  | $e^+ e^- \approx 10$ GeV |
| 0.36 ± 0.04 ± 0.08  | 104       | KINOSHITA             | 91 CLEO  | $e^+ e^- \sim 10.7$ GeV  |

<sup>1</sup> This value is calculated from numbers in Table 1 of ALBRECHT 92P.

$\Gamma(K_L^0 \pi^0)/\Gamma_{\text{total}}$   $\Gamma_{34}/\Gamma$

| VALUE (units $10^{-2}$ )     | EVTS | DOCUMENT ID     | TECN    | COMMENT                   |
|------------------------------|------|-----------------|---------|---------------------------|
| <b>0.998 ± 0.049 ± 0.048</b> | 1116 | <sup>1</sup> HE | 08 CLEO | $e^+ e^-$ at $\psi(3770)$ |

<sup>1</sup> The difference of HE 08  $D^0 \rightarrow K_S^0 \pi^0$  and  $K_L^0 \pi^0$  branching fractions over the sum is  $0.108 \pm 0.025 \pm 0.024$ . This is consistent with U-spin symmetry and the Cabibbo angle.

$\Gamma(K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_{35}/\Gamma$

| VALUE (units $10^{-2}$ )  | EVTS     | DOCUMENT ID            | TECN    | COMMENT                        |
|---|----------|------------------------|---------|--------------------------------|
| • • • We do not use the following data for averages, fits, limits, etc. • • • |          |                        |         |                                |
| 2.52 ± 0.20 ± 0.25  | 284 ± 22 | <sup>1</sup> ALBRECHT  | 94F ARG | $e^+ e^- \approx \Upsilon(4S)$ |
| 3.2 ± 0.3 ± 0.5   |          | ADLER                  | 87 MRK3 | $e^+ e^-$ 3.77 GeV             |
| 2.6 ± 0.8   | 32 ± 8   | <sup>2</sup> SCHINDLER | 81 MRK2 | $e^+ e^-$ 3.771 GeV            |
| 4.0 ± 1.2   | 28       | <sup>3</sup> PERUZZI   | 77 LGW  | $e^+ e^-$ 3.77 GeV             |

<sup>1</sup> See the footnote on the ALBRECHT 94F measurement of  $\Gamma(K^- \pi^+)/\Gamma_{\text{total}}$  for the method used.

<sup>2</sup> SCHINDLER 81 (MARK-2) measures  $\sigma(e^+ e^- \rightarrow \psi(3770)) \times$  branching fraction to be  $0.30 \pm 0.08$  nb. We use the MARK-3 (ADLER 88C) value of  $\sigma = 5.8 \pm 0.5 \pm 0.6$  nb.

<sup>3</sup> PERUZZI 77 (MARK-1) measures  $\sigma(e^+ e^- \rightarrow \psi(3770)) \times$  branching fraction to be  $0.46 \pm 0.12$  nb. We use the MARK-3 (ADLER 88C) value of  $\sigma = 5.8 \pm 0.5 \pm 0.6$  nb.

$\Gamma(K_S^0 \pi^+ \pi^-)/\Gamma(K^- \pi^+)$   $\Gamma_{35}/\Gamma_{31}$

| VALUE   | EVTS                                | DOCUMENT ID | TECN     | COMMENT                                |
|---|-------------------------------------|-------------|----------|--|
| <b>0.73 ± 0.05 OUR FIT</b>  | Error includes scale factor of 1.1. |             |          |  |
| <b>0.81 ± 0.05 ± 0.08</b>   | 856 ± 35                            | FRABETTI    | 94J E687 | $\gamma$ Be $\bar{E}_\gamma = 220$ GeV |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                                     |             |          |  |
| 0.85 ± 0.40   | 35                                  | AVERY       | 80 SPEC  | $\gamma N \rightarrow D^{*+}$          |
| 1.4 ± 0.5   | 116                                 | PICCOLO     | 77 MRK1  | $e^+ e^-$ 4.03, 4.41 GeV               |

$\Gamma(K_S^0 \rho^0)/\Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{36}/\Gamma_{35}$

This is the "fit fraction" from the Dalitz-plot analysis.

| VALUE  | DOCUMENT ID                         | TECN      | COMMENT                          |
|--|-------------------------------------|-----------|----------------------------------|
| <b>0.224 <sup>+0.017</sup>/<sub>-0.023</sub> OUR AVERAGE</b> | Error includes scale factor of 1.7. |           |                                  |
| 0.210 ± 0.016  | <sup>1</sup> AUBERT                 | 08AL BABR | Dalitz fit, $\approx 487$ k evts |
| 0.264 ± 0.009 <sup>+0.010</sup> / <sub>-0.026</sub>          | MURAMATSU                           | 02 CLE2   | Dalitz fit, 5299 evts            |



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

|                                     |          |     |      |   |
|-------------------------------------|----------|-----|------|---|
| $0.267 \pm 0.011^{+0.009}_{-0.028}$ | ASNER    | 04A | CLEO | See MURAMATSU 02                        |
| $0.350 \pm 0.028 \pm 0.067$         | FRABETTI | 94G | E687 | Dalitz fit, 597 evts                    |
| $0.227 \pm 0.032 \pm 0.009$         | ALBRECHT | 93D | ARG  | Dalitz fit, 440 evts                    |
| $0.215 \pm 0.051 \pm 0.037$         | ANJOS    | 93  | E691 | $\gamma$ Be 90–260 GeV                  |
| $0.20 \pm 0.06 \pm 0.03$            | FRABETTI | 92B | E687 | $\gamma$ Be, $\bar{E}_\gamma = 221$ GeV |
| $0.12 \pm 0.01 \pm 0.07$            | ADLER    | 87  | MRK3 | $e^+e^-$ 3.77 GeV                       |

<sup>1</sup>The error on this AUBERT 08AL value includes both statistical and systematic uncertainties; the latter dominates.

### $\Gamma(K_S^0 \omega, \omega \rightarrow \pi^+ \pi^-) / \Gamma(K_S^0 \pi^+ \pi^-)$ $\Gamma_{37} / \Gamma_{35}$

This is the “fit fraction” from the Dalitz-plot analysis.

| <u>VALUE</u>                                      | <u>DOCUMENT ID</u>  | <u>TECN</u> | <u>COMMENT</u>                        |
|---|---------------------|-------------|---------------------------------------|
| <b><math>0.0073 \pm 0.0020</math> OUR AVERAGE</b> |                     |             |                                       |
| $0.009 \pm 0.010$                                 | <sup>1</sup> AUBERT | 08AL        | BABR Dalitz fit, $\approx 487$ k evts |
| $0.0072 \pm 0.0018^{+0.0010}_{-0.0009}$           | MURAMATSU 02        | CLE2        | Dalitz fit, 5299 evts                 |

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

|   |       |     |      |                  |
|---|-------|-----|------|------------------|
| $0.0081 \pm 0.0019^{+0.0018}_{-0.0010}$ | ASNER | 04A | CLEO | See MURAMATSU 02 |
|---|-------|-----|------|------------------|

<sup>1</sup>The error on this AUBERT 08AL value includes both statistical and systematic uncertainties; the latter dominates.

### $\Gamma(K_S^0 (\pi^+ \pi^-)_{S\text{-wave}}) / \Gamma(K_S^0 \pi^+ \pi^-)$ $\Gamma_{38} / \Gamma_{35}$

This is the “fit fraction” from the Dalitz-plot analysis. The  $(\pi^+ \pi^-)_{S\text{-wave}}$  includes what in isobar models are the  $f_0(980)$  and  $f_0(1370)$ ; see the following two data blocks.

| <u>VALUE</u>                        | <u>DOCUMENT ID</u>  | <u>TECN</u> | <u>COMMENT</u>                        |
|-------------------------------------|---------------------|-------------|---------------------------------------|
| <b><math>0.119 \pm 0.026</math></b> | <sup>1</sup> AUBERT | 08AL        | BABR Dalitz fit, $\approx 487$ k evts |

<sup>1</sup>The error on this AUBERT 08AL value includes both statistical and systematic uncertainties; the latter dominates.

### $\Gamma(K_S^0 f_0(980), f_0(980) \rightarrow \pi^+ \pi^-) / \Gamma(K_S^0 \pi^+ \pi^-)$ $\Gamma_{39} / \Gamma_{35}$

This is the “fit fraction” from the Dalitz-plot analysis.

| <u>VALUE</u>  | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>        |
|---|--------------------|-------------|-----------------------|
| <b><math>0.043 \pm 0.005^{+0.012}_{-0.006}</math></b> | MURAMATSU 02       | CLE2        | Dalitz fit, 5299 evts |

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

|                                     |          |     |      |                      |
|-------------------------------------|----------|-----|------|----------------------|
| $0.042 \pm 0.005^{+0.011}_{-0.005}$ | ASNER    | 04A | CLEO | See MURAMATSU 02     |
| $0.068 \pm 0.016 \pm 0.018$         | FRABETTI | 94G | E687 | Dalitz fit, 597 evts |
| $0.046 \pm 0.018 \pm 0.006$         | ALBRECHT | 93D | ARG  | Dalitz fit, 440 evts |

### $\Gamma(K_S^0 f_0(1370), f_0(1370) \rightarrow \pi^+ \pi^-) / \Gamma(K_S^0 \pi^+ \pi^-)$ $\Gamma_{40} / \Gamma_{35}$

This is the “fit fraction” from the Dalitz-plot analysis.

| <u>VALUE</u>  | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>        |
|---|--------------------|-------------|-----------------------|
| <b><math>0.099 \pm 0.011^{+0.028}_{-0.044}</math></b> | MURAMATSU 02       | CLE2        | Dalitz fit, 5299 evts |

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

|                                     |          |     |      |                      |
|-------------------------------------|----------|-----|------|----------------------|
| $0.098 \pm 0.014^{+0.026}_{-0.036}$ | ASNER    | 04A | CLEO | See MURAMATSU 02     |
| $0.077 \pm 0.022 \pm 0.031$         | FRABETTI | 94G | E687 | Dalitz fit, 597 evts |
| $0.082 \pm 0.028 \pm 0.013$         | ALBRECHT | 93D | ARG  | Dalitz fit, 440 evts |

$\Gamma(K_S^0 f_2(1270), f_2(1270) \rightarrow \pi^+ \pi^-) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{41} / \Gamma_{35}$

This is the "fit fraction" from the Dalitz-plot analysis.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

**0.0032<sup>+0.0035</sup><sub>-0.0022</sub> OUR AVERAGE**

|   |                     |           |                          |
|---|---------------------|-----------|--------------------------|
| 0.006 ± 0.007   | <sup>1</sup> AUBERT | 08AL BABR | Dalitz fit, ≈ 487 k evts |
| 0.0027 ± 0.0015 <sup>+0.0037</sup> <sub>-0.0017</sub> | MURAMATSU 02        | CLE2      | Dalitz fit, 5299 evts    |

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

|   |          |          |                      |
|---|----------|----------|----------------------|
| 0.0036 ± 0.0022 <sup>+0.0032</sup> <sub>-0.0019</sub> | ASNER    | 04A CLEO | See MURAMATSU 02     |
| 0.037 ± 0.014 ± 0.017                                 | FRABETTI | 94G E687 | Dalitz fit, 597 evts |
| 0.050 ± 0.021 ± 0.008                                 | ALBRECHT | 93D ARG  | Dalitz fit, 440 evts |

<sup>1</sup>The error on this AUBERT 08AL value includes both statistical and systematic uncertainties; the latter dominates.

$\Gamma(K^*(892)^- \pi^+, K^*(892)^- \rightarrow K_S^0 \pi^-) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{42} / \Gamma_{35}$

This is the "fit fraction" from the Dalitz-plot analysis.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

**0.588<sup>+0.034</sup><sub>-0.050</sub> OUR AVERAGE** Error includes scale factor of 2.0.

|   |                     |           |                          |
|---|---------------------|-----------|--------------------------|
| 0.557 ± 0.028                                     | <sup>1</sup> AUBERT | 08AL BABR | Dalitz fit, ≈ 487 k evts |
| 0.657 ± 0.013 <sup>+0.018</sup> <sub>-0.040</sub> | MURAMATSU 02        | CLE2      | Dalitz fit, 5299 evts    |

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

|   |          |          |  |
|---|----------|----------|--|
| 0.663 ± 0.013 <sup>+0.024</sup> <sub>-0.043</sub> | ASNER    | 04A CLEO | See MURAMATSU 02                       |
| 0.625 ± 0.036 ± 0.026                             | FRABETTI | 94G E687 | Dalitz fit, 597 evts                   |
| 0.718 ± 0.042 ± 0.030                             | ALBRECHT | 93D ARG  | Dalitz fit, 440 evts                   |
| 0.480 ± 0.097                                     | ANJOS    | 93 E691  | γBe 90–260 GeV                         |
| 0.56 ± 0.04 ± 0.05                                | ADLER    | 87 MRK3  | e <sup>+</sup> e <sup>-</sup> 3.77 GeV |

<sup>1</sup>The error on this AUBERT 08AL value includes both statistical and systematic uncertainties; the latter dominates.

$\Gamma(K_0^*(1430)^- \pi^+, K_0^*(1430)^- \rightarrow K_S^0 \pi^-) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{43} / \Gamma_{35}$

This is the "fit fraction" from the Dalitz-plot analysis.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

**0.095<sup>+0.014</sup><sub>-0.010</sub> OUR AVERAGE**

|   |                     |           |                          |
|---|---------------------|-----------|--------------------------|
| 0.102 ± 0.015                                     | <sup>1</sup> AUBERT | 08AL BABR | Dalitz fit, ≈ 487 k evts |
| 0.073 ± 0.007 <sup>+0.031</sup> <sub>-0.011</sub> | MURAMATSU 02        | CLE2      | Dalitz fit, 5299 evts    |

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

|   |          |          |                      |
|---|----------|----------|----------------------|
| 0.072 ± 0.007 <sup>+0.014</sup> <sub>-0.013</sub> | ASNER    | 04A CLEO | See MURAMATSU 02     |
| 0.109 ± 0.027 ± 0.029                             | FRABETTI | 94G E687 | Dalitz fit, 597 evts |
| 0.129 ± 0.034 ± 0.021                             | ALBRECHT | 93D ARG  | Dalitz fit, 440 evts |

<sup>1</sup>The error on this AUBERT 08AL value includes both statistical and systematic uncertainties; the latter dominates.

$$\Gamma(K_2^*(1430)^- \pi^+, K_2^*(1430)^- \rightarrow K_S^0 \pi^-) / \Gamma(K_S^0 \pi^+ \pi^-) \quad \Gamma_{44} / \Gamma_{35}$$

This is the "fit fraction" from the Dalitz-plot analysis.

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------|--------------------|-------------|----------------|
|--------------|--------------------|-------------|----------------|

**0.0120<sup>+0.0070</sup><sub>-0.0035</sub> OUR AVERAGE**

|   |                     |           |                          |
|---|---------------------|-----------|--------------------------|
| 0.022 ± 0.016                                     | <sup>1</sup> AUBERT | 08AL BABR | Dalitz fit, ≈ 487 k evts |
| 0.011 ± 0.002 <sup>+0.007</sup> <sub>-0.003</sub> | MURAMATSU 02        | CLE2      | Dalitz fit, 5299 evts    |

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

|   |       |          |                  |
|---|-------|----------|------------------|
| 0.011 ± 0.002 <sup>+0.005</sup> <sub>-0.003</sub> | ASNER | 04A CLEO | See MURAMATSU 02 |
|---|-------|----------|------------------|

<sup>1</sup>The error on this AUBERT 08AL value includes both statistical and systematic uncertainties; the latter dominates.

$$\Gamma(K^*(1680)^- \pi^+, K^*(1680)^- \rightarrow K_S^0 \pi^-) / \Gamma(K_S^0 \pi^+ \pi^-) \quad \Gamma_{45} / \Gamma_{35}$$

This is the "fit fraction" from the Dalitz-plot analysis.

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------|--------------------|-------------|----------------|
|--------------|--------------------|-------------|----------------|

**0.016 ± 0.013 OUR AVERAGE**

|   |                     |           |                          |
|---|---------------------|-----------|--------------------------|
| 0.007 ± 0.019                                     | <sup>1</sup> AUBERT | 08AL BABR | Dalitz fit, ≈ 487 k evts |
| 0.022 ± 0.004 <sup>+0.018</sup> <sub>-0.015</sub> | MURAMATSU 02        | CLE2      | Dalitz fit, 5299 evts    |

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

|   |       |          |                  |
|---|-------|----------|------------------|
| 0.023 ± 0.005 <sup>+0.007</sup> <sub>-0.014</sub> | ASNER | 04A CLEO | See MURAMATSU 02 |
|---|-------|----------|------------------|

<sup>1</sup>The error on this AUBERT 08AL value includes both statistical and systematic uncertainties; the latter dominates.

$$\Gamma(K^*(892)^+ \pi^-, K^*(892)^+ \rightarrow K_S^0 \pi^+) / \Gamma(K_S^0 \pi^+ \pi^-) \quad \Gamma_{46} / \Gamma_{35}$$

This is the "fit fraction" from the Dalitz-plot analysis. This is a doubly Cabibbo-suppressed mode.

| <u>VALUE (units 10<sup>-3</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------------------------------|--------------------|-------------|----------------|
|--------------------------------------|--------------------|-------------|----------------|

**4.0<sup>+2.0</sup><sub>-1.2</sub> OUR AVERAGE**

|   |                     |           |                          |
|---|---------------------|-----------|--------------------------|
| 4.6 ± 2.3                                 | <sup>1</sup> AUBERT | 08AL BABR | Dalitz fit, ≈ 487 k evts |
| 3.4 ± 1.3 <sup>+4.1</sup> <sub>-0.4</sub> | MURAMATSU 02        | CLE2      | Dalitz fit, 5299 evts    |

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

|   |       |          |                  |
|---|-------|----------|------------------|
| 3.4 ± 1.3 <sup>+3.6</sup> <sub>-0.5</sub> | ASNER | 04A CLEO | See MURAMATSU 02 |
|---|-------|----------|------------------|

<sup>1</sup>The error on this AUBERT 08AL value includes both statistical and systematic uncertainties; the latter dominates.

$$\Gamma(K_0^*(1430)^+ \pi^-, K_0^*(1430)^+ \rightarrow K_S^0 \pi^+) / \Gamma(K_S^0 \pi^+ \pi^-) \quad \Gamma_{47} / \Gamma_{35}$$

This is the "fit fraction" from the Dalitz-plot analysis. This is a doubly Cabibbo-suppressed mode.

| <u>VALUE</u> | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------|------------|--------------------|-------------|----------------|
|--------------|------------|--------------------|-------------|----------------|

|                        |    |        |           |                          |
|------------------------|----|--------|-----------|--------------------------|
| < 5 × 10 <sup>-4</sup> | 95 | AUBERT | 08AL BABR | Dalitz fit, ≈ 487 k evts |
|------------------------|----|--------|-----------|--------------------------|

$$\Gamma(K_2^*(1430)^+ \pi^-, K_2^*(1430)^+ \rightarrow K_S^0 \pi^+) / \Gamma(K_S^0 \pi^+ \pi^-) \quad \Gamma_{48} / \Gamma_{35}$$

This is the "fit fraction" from the Dalitz-plot analysis. This is a doubly Cabibbo-suppressed mode.

| <u>VALUE</u> | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------|------------|--------------------|-------------|----------------|
|--------------|------------|--------------------|-------------|----------------|

|                          |    |        |           |                          |
|--------------------------|----|--------|-----------|--------------------------|
| < 1.2 × 10 <sup>-3</sup> | 95 | AUBERT | 08AL BABR | Dalitz fit, ≈ 487 k evts |
|--------------------------|----|--------|-----------|--------------------------|

$\Gamma(K_S^0 \pi^+ \pi^- \text{ nonresonant}) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{49} / \Gamma_{35}$

This is the "fit fraction" from the Dalitz-plot analysis. Neither FRABETTI 94G nor ALBRECHT 93D (quoted in many of the earlier submodes of  $K_S^0 \pi^+ \pi^-$ ) sees evidence for a nonresonant component.

| VALUE  | DOCUMENT ID  | TECN | COMMENT               |
|--|--------------|------|-----------------------|
| <b>0.009 ± 0.004</b> <sup>+0.020</sup> <sub>-0.004</sub> | MURAMATSU 02 | CLE2 | Dalitz fit, 5299 evts |

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

|   |          |     |      |   |
|---|----------|-----|------|---|
| 0.007 ± 0.007 <sup>+0.021</sup> <sub>-0.006</sub> | ASNER    | 04A | CLEO | See MURAMATSU 02                        |
| 0.263 ± 0.024 ± 0.041                             | ANJOS    | 93  | E691 | $\gamma$ Be 90–260 GeV                  |
| 0.26 ± 0.08 ± 0.05                                | FRABETTI | 92B | E687 | $\gamma$ Be, $\bar{E}_\gamma = 221$ GeV |
| 0.33 ± 0.05 ± 0.10                                | ADLER    | 87  | MRK3 | $e^+ e^-$ 3.77 GeV                      |

$\Gamma(K^- \pi^+ \pi^0) / \Gamma_{\text{total}}$   $\Gamma_{50} / \Gamma$

| VALUE (units $10^{-2}$ )      | EVTS | DOCUMENT ID  | TECN | COMMENT                             |
|-------------------------------|------|--------------|------|-------------------------------------|
| <b>14.3 ± 0.8 OUR FIT</b>     |      |              |      | Error includes scale factor of 3.1. |
| <b>14.956 ± 0.074 ± 0.335</b> |      | BONVICINI 14 | CLEO | All CLEO-c runs                     |

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

|                     |           |                        |     |      |                     |
|---------------------|-----------|------------------------|-----|------|---------------------|
| 14.57 ± 0.12 ± 0.38 |           | <sup>1</sup> DOBBS     | 07  | CLEO | See BONVICINI 14    |
| 14.9 ± 0.3 ± 0.5    | 19k ± 150 | <sup>1</sup> HE        | 05  | CLEO | See DOBBS 07        |
| 13.3 ± 1.2 ± 1.3    | 931       | ADLER                  | 88C | MRK3 | $e^+ e^-$ 3.77 GeV  |
| 11.7 ± 4.3          | 37        | <sup>2</sup> SCHINDLER | 81  | MRK2 | $e^+ e^-$ 3.771 GeV |

<sup>1</sup> DOBBS 07 and HE 05 use single- and double-tagged events in an overall fit. DOBBS 07 supersedes HE 05.

<sup>2</sup> SCHINDLER 81 (MARK-2) measures  $\sigma(e^+ e^- \rightarrow \psi(3770)) \times$  branching fraction to be  $0.68 \pm 0.23$  nb. We use the MARK-3 (ADLER 88C) value of  $\sigma = 5.8 \pm 0.5 \pm 0.6$  nb.

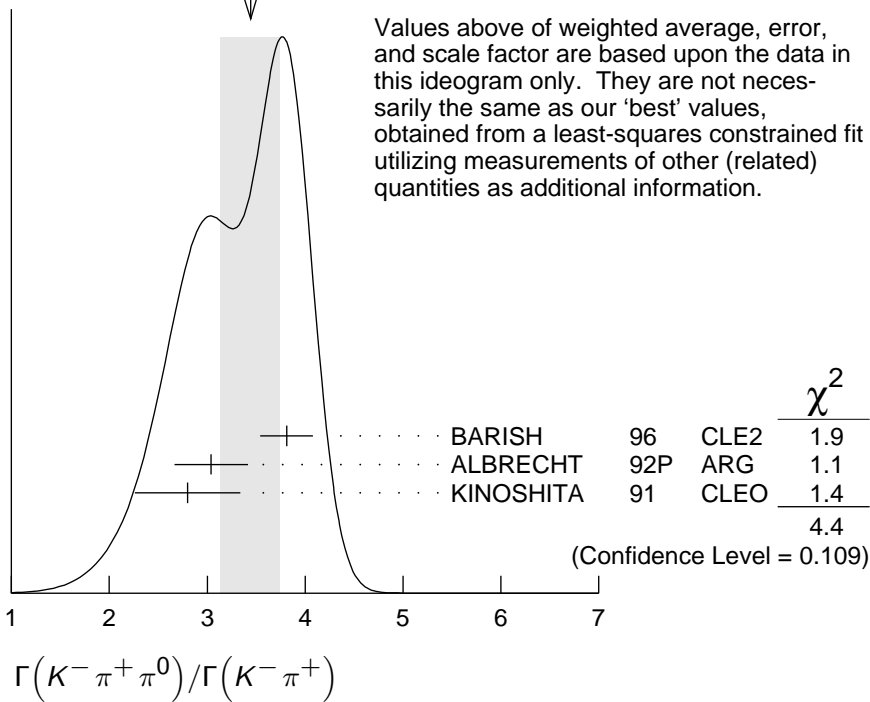
$\Gamma(K^- \pi^+ \pi^0) / \Gamma(K^- \pi^+)$   $\Gamma_{50} / \Gamma_{31}$

| VALUE                          | EVTS | DOCUMENT ID | TECN | COMMENT   |
|--------------------------------|------|-------------|------|---|
| <b>3.63 ± 0.22 OUR FIT</b>     |      |             |      | Error includes scale factor of 3.0.                         |
| <b>3.44 ± 0.30 OUR AVERAGE</b> |      |             |      | Error includes scale factor of 1.5. See the ideogram below. |

|                    |      |                       |     |      |                                |
|--------------------|------|-----------------------|-----|------|--------------------------------|
| 3.81 ± 0.07 ± 0.26 | 10k  | BARISH                | 96  | CLE2 | $e^+ e^- \approx \Upsilon(4S)$ |
| 3.04 ± 0.16 ± 0.34 | 931  | <sup>1</sup> ALBRECHT | 92P | ARG  | $e^+ e^- \approx 10$ GeV       |
| 2.8 ± 0.14 ± 0.52  | 1050 | KINOSHITA             | 91  | CLEO | $e^+ e^- \sim 10.7$ GeV        |

<sup>1</sup> This value is calculated from numbers in Table 1 of ALBRECHT 92P.

WEIGHTED AVERAGE  
3.44±0.30 (Error scaled by 1.5)



$\Gamma(K^- \rho^+) / \Gamma(K^- \pi^+ \pi^0)$

$\Gamma_{51} / \Gamma_{50}$

This is the "fit fraction" from the Dalitz-plot analysis.

| VALUE   | DOCUMENT ID | TECN     | COMMENT                                |
|---|-------------|----------|--|
| <b>0.78 ± 0.04 OUR AVERAGE</b>  |             |          |  |
| 0.788 ± 0.019 ± 0.048   | KOPP        | 01 CLE2  | Dalitz fit, ≈ 7,000 evts               |
| 0.765 ± 0.041 ± 0.054   | FRABETTI    | 94G E687 | Dalitz fit, 530 evts                   |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |          |  |
| 0.647 ± 0.039 ± 0.150   | ANJOS       | 93 E691  | γBe 90–260 GeV                         |
| 0.81 ± 0.03 ± 0.06  | ADLER       | 87 MRK3  | e <sup>+</sup> e <sup>-</sup> 3.77 GeV |

$\Gamma(K^- \rho(1700)^+, \rho(1700)^+ \rightarrow \pi^+ \pi^0) / \Gamma(K^- \pi^+ \pi^0)$

$\Gamma_{52} / \Gamma_{50}$

This is the "fit fraction" from the Dalitz-plot analysis.

| VALUE                        | DOCUMENT ID | TECN    | COMMENT                  |
|------------------------------|-------------|---------|--------------------------|
| <b>0.057 ± 0.008 ± 0.009</b> | KOPP        | 01 CLE2 | Dalitz fit, ≈ 7,000 evts |

$\Gamma(K^*(892)^- \pi^+, K^*(892)^- \rightarrow K^- \pi^0) / \Gamma(K^- \pi^+ \pi^0)$

$\Gamma_{53} / \Gamma_{50}$

This is the "fit fraction" from the Dalitz-plot analysis.

| VALUE   | DOCUMENT ID | TECN     | COMMENT                                |
|---|-------------|----------|--|
| <b>0.160<sup>+0.025</sup><sub>-0.013</sub> OUR AVERAGE</b>                    |             |          |  |
| 0.161 ± 0.007 <sup>+0.027</sup> <sub>-0.011</sub>                             | KOPP        | 01 CLE2  | Dalitz fit, ≈ 7,000 evts               |
| 0.148 ± 0.028 ± 0.049   | FRABETTI    | 94G E687 | Dalitz fit, 530 evts                   |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |          |  |
| 0.084 ± 0.011 ± 0.012   | ANJOS       | 93 E691  | γBe 90–260 GeV                         |
| 0.12 ± 0.02 ± 0.03  | ADLER       | 87 MRK3  | e <sup>+</sup> e <sup>-</sup> 3.77 GeV |

$\Gamma(\bar{K}^*(892)^0 \pi^0, \bar{K}^*(892)^0 \rightarrow K^- \pi^+) / \Gamma(K^- \pi^+ \pi^0)$   $\Gamma_{54} / \Gamma_{50}$

This is the "fit fraction" from the Dalitz-plot analysis.

| <u>VALUE</u>  | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                         |
|---|--------------------|-------------|--|
| <b>0.135 ± 0.016 OUR AVERAGE</b>  |                    |             |  |
| 0.127 ± 0.009 ± 0.016   | KOPP               | 01 CLE2     | Dalitz fit, ≈ 7,000 evts               |
| 0.165 ± 0.031 ± 0.015   | FRABETTI           | 94G E687    | Dalitz fit, 530 evts                   |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                    |             |  |
| 0.142 ± 0.018 ± 0.024   | ANJOS              | 93 E691     | γBe 90–260 GeV                         |
| 0.13 ± 0.02 ± 0.03  | ADLER              | 87 MRK3     | e <sup>+</sup> e <sup>-</sup> 3.77 GeV |

$\Gamma(K_0^*(1430)^- \pi^+, K_0^*(1430)^- \rightarrow K^- \pi^0) / \Gamma(K^- \pi^+ \pi^0)$   $\Gamma_{55} / \Gamma_{50}$

This is the "fit fraction" from the Dalitz-plot analysis.

| <u>VALUE</u>                 | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|------------------------------|--------------------|-------------|--------------------------|
| <b>0.033 ± 0.006 ± 0.014</b> | KOPP               | 01 CLE2     | Dalitz fit, ≈ 7,000 evts |

$\Gamma(\bar{K}_0^*(1430)^0 \pi^0, \bar{K}_0^*(1430)^0 \rightarrow K^- \pi^+) / \Gamma(K^- \pi^+ \pi^0)$   $\Gamma_{56} / \Gamma_{50}$

This is the "fit fraction" from the Dalitz-plot analysis.

| <u>VALUE</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|--|--------------------|-------------|--------------------------|
| <b>0.041 ± 0.006<sup>+0.032</sup><sub>-0.009</sub></b> | KOPP               | 01 CLE2     | Dalitz fit, ≈ 7,000 evts |

$\Gamma(K^*(1680)^- \pi^+, K^*(1680)^- \rightarrow K^- \pi^0) / \Gamma(K^- \pi^+ \pi^0)$   $\Gamma_{57} / \Gamma_{50}$

This is the "fit fraction" from the Dalitz-plot analysis.

| <u>VALUE</u>                 | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|------------------------------|--------------------|-------------|--------------------------|
| <b>0.013 ± 0.003 ± 0.004</b> | KOPP               | 01 CLE2     | Dalitz fit, ≈ 7,000 evts |

$\Gamma(K^- \pi^+ \pi^0 \text{ nonresonant}) / \Gamma(K^- \pi^+ \pi^0)$   $\Gamma_{58} / \Gamma_{50}$

This is the "fit fraction" from the Dalitz-plot analysis.

| <u>VALUE</u>  | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                         |
|---|-------------|--------------------|-------------|--|
| <b>0.080<sup>+0.040</sup><sub>-0.014</sub></b>                                |             |                    |             | <b>OUR AVERAGE</b>                     |
| 0.075 ± 0.009 <sup>+0.056</sup> <sub>-0.011</sub>                             |             | KOPP               | 01 CLE2     | Dalitz fit, ≈ 7,000 evts               |
| 0.101 ± 0.033 ± 0.040   |             | FRABETTI           | 94G E687    | Dalitz fit, 530 evts                   |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |                    |             |  |
| 0.036 ± 0.004 ± 0.018   |             | ANJOS              | 93 E691     | γBe 90–260 GeV                         |
| 0.09 ± 0.02 ± 0.04  |             | ADLER              | 87 MRK3     | e <sup>+</sup> e <sup>-</sup> 3.77 GeV |
| 0.51 ± 0.22   | 21          | SUMMERS            | 84 E691     | Photoproduction                        |

$\Gamma(K_S^0 2\pi^0) / \Gamma_{\text{total}}$   $\Gamma_{59} / \Gamma$

| <u>VALUE (units 10<sup>-3</sup>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>   |
|--------------------------------------|-------------|--------------------|-------------|--|
| <b>9.1 ± 1.1 OUR AVERAGE</b>         |             |                    |             | Error includes scale factor of 2.2.                                      |
| 10.58 ± 0.38 ± 0.73                  | 1259        | LOWREY             | 11 CLEO     | e <sup>+</sup> e <sup>-</sup> ≈ 3.77 GeV                                 |
| 8.34 ± 0.45 ± 0.42                   |             | ASNER              | 08 CLEO     | e <sup>+</sup> e <sup>-</sup> → D <sup>0</sup> $\bar{D}^0$ ,<br>3.77 GeV |

$\Gamma(K_S^0(2\pi^0)\text{-S-wave}) / \Gamma(K_S^0 2\pi^0)$   $\Gamma_{60} / \Gamma_{59}$

| <u>VALUE (%)</u>        | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>             |
|-------------------------|--------------------|-------------|----------------------------|
| <b>28.9 ± 6.3 ± 3.1</b> | LOWREY             | 11 CLEO     | Dalitz analysis, 1259 evts |

$\Gamma(\bar{K}^*(892)^0 \pi^0, \bar{K}^*(892)^0 \rightarrow K_S^0 \pi^0) / \Gamma(K_S^0 \pi^0)$   $\Gamma_{61} / \Gamma_{33}$

| VALUE (%)   | DOCUMENT ID  | TECN | COMMENT                    |
|---|--------------|------|----------------------------|
| <b>65.6 ± 5.3 ± 2.5</b>   | LOWREY 11    | CLEO | Dalitz analysis, 1259 evts |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |              |      |                            |
| 55 <sup>+13</sup> <sub>-10</sub> ± 7  | PROCARIO 93B | CLE2 | Dalitz plot fit, 122 evts  |

$\Gamma(\bar{K}^*(1430)^0 \pi^0, \bar{K}^{*0} \rightarrow K_S^0 \pi^0) / \Gamma(K_S^0 2\pi^0)$   $\Gamma_{62} / \Gamma_{59}$

| VALUE (%)                 | DOCUMENT ID | TECN | COMMENT                    |
|---------------------------|-------------|------|----------------------------|
| <b>0.49 ± 0.45 ± 2.51</b> | LOWREY 11   | CLEO | Dalitz analysis, 1259 evts |

$\Gamma(\bar{K}^*(1680)^0 \pi^0, \bar{K}^{*0} \rightarrow K_S^0 \pi^0) / \Gamma(K_S^0 2\pi^0)$   $\Gamma_{63} / \Gamma_{59}$

| VALUE (%)               | DOCUMENT ID | TECN | COMMENT                    |
|-------------------------|-------------|------|----------------------------|
| <b>11.2 ± 2.7 ± 2.5</b> | LOWREY 11   | CLEO | Dalitz analysis, 1259 evts |

$\Gamma(K_S^0 f_2(1270), f_2 \rightarrow 2\pi^0) / \Gamma(K_S^0 2\pi^0)$   $\Gamma_{64} / \Gamma_{59}$

| VALUE (%)                 | DOCUMENT ID | TECN | COMMENT                    |
|---------------------------|-------------|------|----------------------------|
| <b>2.48 ± 0.91 ± 0.78</b> | LOWREY 11   | CLEO | Dalitz analysis, 1259 evts |

$\Gamma(2K_S^0, \text{one } K_S^0 \rightarrow 2\pi^0) / \Gamma(K_S^0 2\pi^0)$   $\Gamma_{65} / \Gamma_{59}$

| VALUE (%)                 | DOCUMENT ID | TECN | COMMENT                    |
|---------------------------|-------------|------|----------------------------|
| <b>3.46 ± 0.92 ± 0.66</b> | LOWREY 11   | CLEO | Dalitz analysis, 1259 evts |

$\Gamma(K_S^0 2\pi^0 \text{ nonresonant}) / \Gamma(K_S^0 \pi^0)$   $\Gamma_{66} / \Gamma_{33}$

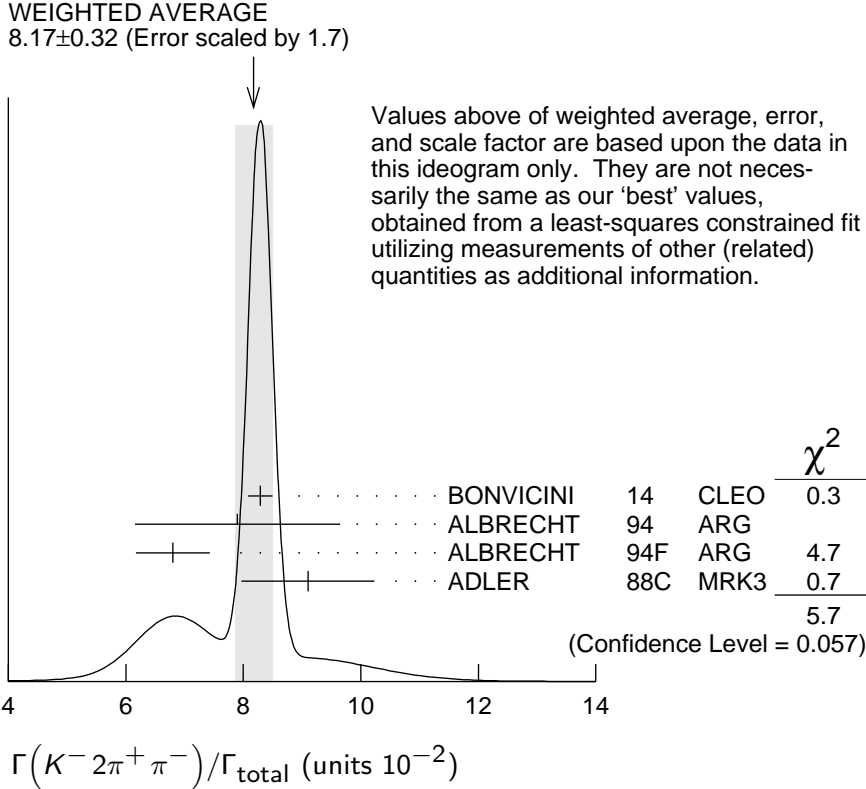
| VALUE              | DOCUMENT ID  | TECN | COMMENT                   |
|--------------------|--------------|------|---------------------------|
| 0.37 ± 0.08 ± 0.04 | PROCARIO 93B | CLE2 | Dalitz plot fit, 122 evts |

$\Gamma(K^- 2\pi^+ \pi^-) / \Gamma_{\text{total}}$   $\Gamma_{67} / \Gamma$

| VALUE (units 10 <sup>-2</sup> )   | EVTS               | DOCUMENT ID   | TECN | COMMENT  |
|---|--------------------|---|------|--|
| <b>8.07 ± 0.23</b>  | <b>OUR FIT</b>     | Error includes scale factor of 1.5.                         |      |  |
| <b>8.17 ± 0.32</b>  | <b>OUR AVERAGE</b> | Error includes scale factor of 1.7. See the ideogram below. |      |  |
| 8.287 ± 0.043 ± 0.200   |                    | BONVICINI 14  | CLEO | All CLEO-c runs                                |
| 7.9 ± 1.5 ± 0.9   |                    | <sup>1</sup> ALBRECHT 94                                    | ARG  | e <sup>+</sup> e <sup>-</sup> ≈ $\Upsilon(4S)$ |
| 6.80 ± 0.27 ± 0.57  | 1.4k               | <sup>2</sup> ALBRECHT 94F                                   | ARG  | e <sup>+</sup> e <sup>-</sup> ≈ $\Upsilon(4S)$ |
| 9.1 ± 0.8 ± 0.8   | 992                | ADLER 88C   | MRK3 | e <sup>+</sup> e <sup>-</sup> 3.77 GeV         |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                    |   |      |  |
| 8.30 ± 0.07 ± 0.20  |                    | <sup>3</sup> DOBBS 07                                       | CLEO | See BONVICINI 14                               |
| 8.3 ± 0.2 ± 0.3   | 15k                | <sup>3</sup> HE 05  | CLEO | See DOBBS 07                                   |
| 11.7 ± 2.5  | 185                | <sup>4</sup> SCHINDLER 81                                   | MRK2 | e <sup>+</sup> e <sup>-</sup> 3.771 GeV        |
| 6.2 ± 1.9   | 44                 | <sup>5</sup> PERUZZI 77                                     | LGW  | e <sup>+</sup> e <sup>-</sup> 3.77 GeV         |

<sup>1</sup> ALBRECHT 94 uses  $D^0$  mesons from  $\bar{B}^0 \rightarrow D^{*+} \ell^- \bar{\nu}_\ell$  decays. This is a different set of events than used by ALBRECHT 94F.  
<sup>2</sup> See the footnote on the ALBRECHT 94F measurement of  $\Gamma(K^- \pi^+) / \Gamma_{\text{total}}$  for the method used.  
<sup>3</sup> DOBBS 07 and HE 05 use single- and double-tagged events in an overall fit. DOBBS 07 supersedes HE 05.

- <sup>4</sup> SCHINDLER 81 (MARK-2) measures  $\sigma(e^+e^- \rightarrow \psi(3770)) \times$  branching fraction to be  $0.68 \pm 0.11$  nb. We use the MARK-3 (ADLER 88C) value of  $\sigma = 5.8 \pm 0.5 \pm 0.6$  nb.  
<sup>5</sup> PERUZZI 77 (MARK-1) measures  $\sigma(e^+e^- \rightarrow \psi(3770)) \times$  branching fraction to be  $0.36 \pm 0.10$  nb. We use the MARK-3 (ADLER 88C) value of  $\sigma = 5.8 \pm 0.5 \pm 0.6$  nb.



**$\Gamma(K^- 2\pi^+ \pi^-) / \Gamma(K^- \pi^+)$   $\Gamma_{67} / \Gamma_{31}$**

VALUE                      EVTS                      DOCUMENT ID                      TECN                      COMMENT

**2.05 ± 0.06 OUR FIT**      Error includes scale factor of 1.4.

**1.97 ± 0.09 OUR AVERAGE**

|                                 |      |              |     |      |                             |
|---------------------------------|------|--------------|-----|------|-----------------------------|
| $1.94 \pm 0.07^{+0.09}_{-0.11}$ |      | JUN          | 00  | SELX | $\Sigma^-$ nucleus, 600 GeV |
| $1.7 \pm 0.2 \pm 0.2$           | 1745 | ANJOS        | 92C | E691 | $\gamma$ Be 90–260 GeV      |
| $1.90 \pm 0.25 \pm 0.20$        | 337  | ALVAREZ      | 91B | NA14 | Photoproduction             |
| $2.12 \pm 0.16 \pm 0.09$        |      | BORTOLETTO88 |     | CLEO | $e^+e^-$ 10.55 GeV          |
| $2.17 \pm 0.28 \pm 0.23$        |      | ALBRECHT     | 85F | ARG  | $e^+e^-$ 10 GeV             |

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

|               |     |         |     |      |                              |
|---------------|-----|---------|-----|------|------------------------------|
| $2.0 \pm 0.9$ | 48  | BAILEY  | 86  | ACCM | $\pi^-$ Be fixed target      |
| $2.0 \pm 1.0$ | 10  | BAILEY  | 83B | SPEC | $\pi^-$ Be $\rightarrow D^0$ |
| $2.2 \pm 0.8$ | 214 | PICCOLO | 77  | MRK1 | $e^+e^-$ 4.03, 4.41 GeV      |

**$\Gamma(K^- \pi^+ \rho^0 \text{ total}) / \Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{68} / \Gamma_{67}$**

This includes  $K^- a_1(1260)^+$ ,  $\bar{K}^*(892)^0 \rho^0$ , etc. The next entry gives the specifically 3-body fraction. We rely on the MARK III and E691 full amplitude analyses of the  $K^- \pi^+ \pi^+ \pi^-$  channel for values of the resonant substructure.



| <u>VALUE</u>  | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                    |
|---|--------------------|-------------|-----------------------------------|
| <b>0.835±0.035 OUR AVERAGE</b>  |                    |             |                                   |
| 0.80 ±0.03 ±0.05  | ANJOS              | 92C E691    | 1745 $K^- 2\pi^+ \pi^-$ evts      |
| 0.855±0.032±0.030   | COFFMAN            | 92B MRK3    | 1281 ± 45 $K^- 2\pi^+ \pi^-$ evts |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |                    |             |                                   |
| 0.98 ±0.12 ±0.10  | ALVAREZ            | 91B NA14    | Photoproduction                   |

$\Gamma(K^- \pi^+ \rho^0 \text{3-body})/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{69}/\Gamma_{67}$

We rely on the MARK III and E691 full amplitude analyses of the  $K^- \pi^+ \pi^+ \pi^-$  channel for values of the resonant substructure.

| <u>VALUE</u>  | <u>EVTS</u> | <u>DOCUMENT ID</u>   | <u>TECN</u> | <u>COMMENT</u>                    |
|---|-------------|----------------------|-------------|-----------------------------------|
| <b>0.063±0.028 OUR AVERAGE</b>  |             |                      |             |                                   |
| 0.05 ±0.03 ±0.02  |             | ANJOS                | 92C E691    | 1745 $K^- 2\pi^+ \pi^-$ evts      |
| 0.084±0.022±0.04  |             | COFFMAN              | 92B MRK3    | 1281 ± 45 $K^- 2\pi^+ \pi^-$ evts |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |             |                      |             |                                   |
| 0.77 ±0.06 ±0.06  |             | <sup>1</sup> ALVAREZ | 91B NA14    | Photoproduction                   |
| 0.85 <sup>+0.11</sup> <sub>-0.22</sub>  | 180         | PICCOLO              | 77 MRK1     | $e^+ e^-$ 4.03, 4.41 GeV          |

<sup>1</sup> This value is for  $\rho^0 (K^- \pi^+)$ -nonresonant. ALVAREZ 91B cannot determine what fraction of this is  $K^- a_1(1260)^+$ .

$\Gamma(\bar{K}^*(892)^0 \rho^0)/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{101}/\Gamma_{67}$

Unseen decay modes of the  $\bar{K}^*(892)^0$  are included. We rely on the MARK III and E691 full amplitude analyses of the  $K^- \pi^+ \pi^+ \pi^-$  channel for values of the resonant substructure.

| <u>VALUE</u>  | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                  |
|---|-------------|--------------------|-------------|---------------------------------|
| <b>0.195±0.03±0.03</b>  |             | ANJOS              | 92C E691    | 1745 $K^- 2\pi^+ \pi^-$ evts    |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |             |                    |             |                                 |
| 0.34 ±0.09±0.09   |             | ALVAREZ            | 91B NA14    | Photoproduction                 |
| 0.75 ±0.3   | 5           | BAILEY             | 83B SPEC    | $\pi \text{Be} \rightarrow D^0$ |
| 0.15 <sup>+0.16</sup> <sub>-0.15</sub>  | 20          | PICCOLO            | 77 MRK1     | $e^+ e^-$ 4.03, 4.41 GeV        |

$\Gamma(\bar{K}^*(892)^0 \rho^0 \text{transverse})/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{102}/\Gamma_{67}$

Unseen decay modes of the  $\bar{K}^*(892)^0$  are included.

| <u>VALUE</u>             | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                    |
|--------------------------|--------------------|-------------|-----------------------------------|
| <b>0.213±0.024±0.075</b> | COFFMAN            | 92B MRK3    | 1281 ± 45 $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(\bar{K}^*(892)^0 \rho^0 \text{S-wave})/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{103}/\Gamma_{67}$

Unseen decay modes of the  $\bar{K}^*(892)^0$  are included.

| <u>VALUE</u>            | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>               |
|-------------------------|--------------------|-------------|------------------------------|
| <b>0.375±0.045±0.06</b> | ANJOS              | 92C E691    | 1745 $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(\bar{K}^*(892)^0 \rho^0 \text{S-wave long.})/\Gamma_{\text{total}}$   $\Gamma_{104}/\Gamma$

Unseen decay modes of the  $\bar{K}^*(892)^0$  are included.

| <u>VALUE</u>     | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                    |
|------------------|------------|--------------------|-------------|-----------------------------------|
| <b>&lt;0.003</b> | 90         | COFFMAN            | 92B MRK3    | 1281 ± 45 $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(\bar{K}^*(892)^0 \rho^0 P\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_{105}/\Gamma$

Unseen decay modes of the  $\bar{K}^*(892)^0$  are included.

| VALUE   | CL% | DOCUMENT ID | TECN     | COMMENT                      |
|---|-----|-------------|----------|------------------------------|
| <b>&lt;0.003</b>  | 90  | COFFMAN     | 92B MRK3 | 1.3k $K^- 2\pi^+ \pi^-$ evts |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |             |          |                              |
| <0.009  | 90  | ANJOS       | 92C E691 | 1745 $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(\bar{K}^*(892)^0 \rho^0 D\text{-wave})/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{106}/\Gamma_{67}$

Unseen decay modes of the  $\bar{K}^*(892)^0$  are included.

| VALUE  | DOCUMENT ID | TECN     | COMMENT                      |
|--|-------------|----------|------------------------------|
| <b><math>0.255 \pm 0.045 \pm 0.06</math></b> | ANJOS       | 92C E691 | 1745 $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(K^- \pi^+ f_0(980))/\Gamma_{\text{total}}$   $\Gamma_{107}/\Gamma$

| VALUE   | CL% | DOCUMENT ID | TECN     | COMMENT                      |
|---|-----|-------------|----------|------------------------------|
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |             |          |                              |
| <0.011  | 90  | ANJOS       | 92C E691 | 1745 $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(\bar{K}^*(892)^0 f_0(980))/\Gamma_{\text{total}}$   $\Gamma_{108}/\Gamma$

| VALUE   | CL% | DOCUMENT ID | TECN     | COMMENT                      |
|---|-----|-------------|----------|------------------------------|
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |             |          |                              |
| <0.007  | 90  | ANJOS       | 92C E691 | 1745 $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(K^- a_1(1260)^+)/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{97}/\Gamma_{67}$

Unseen decay modes of the  $a_1(1260)^+$  are included, assuming that the  $a_1(1260)^+$  decays entirely to  $\rho\pi$  [or at least to  $(\pi\pi)_{I=1} \pi$ ].

| VALUE   | DOCUMENT ID | TECN     | COMMENT                               |
|---|-------------|----------|---------------------------------------|
| <b><math>0.97 \pm 0.14</math> OUR AVERAGE</b> |             |          |                                       |
| 0.94 $\pm 0.13 \pm 0.20$                      | ANJOS       | 92C E691 | 1745 $K^- 2\pi^+ \pi^-$ evts          |
| 0.984 $\pm 0.048 \pm 0.16$                    | COFFMAN     | 92B MRK3 | 1281 $\pm 45$ $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(K^- a_2(1320)^+)/\Gamma_{\text{total}}$   $\Gamma_{98}/\Gamma$

Unseen decay modes of the  $a_2(1320)^+$  are included.

| VALUE   | CL% | DOCUMENT ID | TECN     | COMMENT                               |
|---|-----|-------------|----------|---------------------------------------|
| <b>&lt;0.002</b>  | 90  | ANJOS       | 92C E691 | 1745 $K^- 2\pi^+ \pi^-$ evts          |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |             |          |                                       |
| <0.006  | 90  | COFFMAN     | 92B MRK3 | 1281 $\pm 45$ $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(K_1(1270)^- \pi^+)/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{109}/\Gamma_{67}$

Unseen decay modes of the  $K_1(1270)^-$  are included. The MARK3 and E691 experiments disagree considerably here.

| VALUE   | CL% | DOCUMENT ID | TECN     | COMMENT                               |
|---|-----|-------------|----------|---------------------------------------|
| <b><math>0.194 \pm 0.056 \pm 0.088</math></b>                                 |     | COFFMAN     | 92B MRK3 | 1281 $\pm 45$ $K^- 2\pi^+ \pi^-$ evts |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |             |          |                                       |
| <0.013  | 90  | ANJOS       | 92C E691 | 1745 $K^- 2\pi^+ \pi^-$ evts          |

$\Gamma(K_1(1400)^- \pi^+)/\Gamma_{\text{total}}$   $\Gamma_{110}/\Gamma$

| VALUE            | CL% | DOCUMENT ID | TECN     | COMMENT                               |
|------------------|-----|-------------|----------|---------------------------------------|
| <b>&lt;0.012</b> | 90  | COFFMAN     | 92B MRK3 | 1281 $\pm 45$ $K^- 2\pi^+ \pi^-$ evts |

$\Gamma(K^*(1410)^-\pi^+)/\Gamma_{\text{total}}$   $\Gamma_{111}/\Gamma$

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|-------|-----|-------------|------|---------|
|-------|-----|-------------|------|---------|

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

|        |    |         |     |                                       |
|--------|----|---------|-----|---------------------------------------|
| <0.012 | 90 | COFFMAN | 92B | MRK3 1281 ± 45 $K^- 2\pi^+\pi^-$ evts |
|--------|----|---------|-----|---------------------------------------|

$\Gamma(\bar{K}^*(892)^0\pi^+\pi^- \text{ total})/\Gamma(K^- 2\pi^+\pi^-)$   $\Gamma_{99}/\Gamma_{67}$

This includes  $\bar{K}^*(892)^0\rho^0$ , etc. The next entry gives the specifically 3-body fraction. Unseen decay modes of the  $\bar{K}^*(892)^0$  are included.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

|                           |       |     |                                  |
|---------------------------|-------|-----|----------------------------------|
| <b>0.30 ± 0.06 ± 0.03</b> | ANJOS | 92C | E691 1745 $K^- 2\pi^+\pi^-$ evts |
|---------------------------|-------|-----|----------------------------------|

$\Gamma(\bar{K}^*(892)^0\pi^+\pi^- \text{ 3-body})/\Gamma(K^- 2\pi^+\pi^-)$   $\Gamma_{100}/\Gamma_{67}$

Unseen decay modes of the  $\bar{K}^*(892)^0$  are included.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

**0.18 ± 0.04 OUR AVERAGE**

|                      |       |     |                                  |
|----------------------|-------|-----|----------------------------------|
| 0.165 ± 0.03 ± 0.045 | ANJOS | 92C | E691 1745 $K^- 2\pi^+\pi^-$ evts |
|----------------------|-------|-----|----------------------------------|

|                      |         |     |                                       |
|----------------------|---------|-----|---------------------------------------|
| 0.210 ± 0.027 ± 0.06 | COFFMAN | 92B | MRK3 1281 ± 45 $K^- 2\pi^+\pi^-$ evts |
|----------------------|---------|-----|---------------------------------------|

$\Gamma(K^- 2\pi^+\pi^- \text{ nonresonant})/\Gamma(K^- 2\pi^+\pi^-)$   $\Gamma_{75}/\Gamma_{67}$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

**0.233 ± 0.032 OUR AVERAGE**

|                    |       |     |                                  |
|--------------------|-------|-----|----------------------------------|
| 0.23 ± 0.02 ± 0.03 | ANJOS | 92C | E691 1745 $K^- 2\pi^+\pi^-$ evts |
|--------------------|-------|-----|----------------------------------|

|                      |         |     |                                       |
|----------------------|---------|-----|---------------------------------------|
| 0.242 ± 0.025 ± 0.06 | COFFMAN | 92B | MRK3 1281 ± 45 $K^- 2\pi^+\pi^-$ evts |
|----------------------|---------|-----|---------------------------------------|

$\Gamma(K_S^0\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{76}/\Gamma$

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

**5.2 ± 0.6 OUR FIT**

|                        |     |         |     |                        |
|------------------------|-----|---------|-----|------------------------|
| <b>5.2 ± 1.1 ± 1.2</b> | 140 | COFFMAN | 92B | MRK3 $e^+e^-$ 3.77 GeV |
|------------------------|-----|---------|-----|------------------------|

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

|                     |  |                     |     |                         |
|---------------------|--|---------------------|-----|-------------------------|
| $6.7^{+1.6}_{-1.7}$ |  | <sup>1</sup> BARLAG | 92C | ACCM $\pi^-$ Cu 230 GeV |
|---------------------|--|---------------------|-----|-------------------------|

<sup>1</sup> BARLAG 92C computes the branching fraction using topological normalization.

$\Gamma(K_S^0\pi^+\pi^-\pi^0)/\Gamma(K_S^0\pi^+\pi^-)$   $\Gamma_{76}/\Gamma_{35}$

Branching fractions for submodes of this mode with narrow resonances (the  $\eta$ ,  $\omega$ ,  $\eta'$ ) are fairly well determined (see below). COFFMAN 92B gives fractions of  $K^*$  and  $\rho$  submodes, but with only  $140 \pm 28$  events above background could not determine them with much accuracy. We omit those measurements here; they are in our 2008 Review (Physics Letters **B667** 1 (2008)).

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

**1.84 ± 0.20 OUR FIT**

**1.86 ± 0.23 OUR AVERAGE**

|                    |     |                       |     |                             |
|--------------------|-----|-----------------------|-----|-----------------------------|
| 1.80 ± 0.20 ± 0.21 | 190 | <sup>1</sup> ALBRECHT | 92P | ARG $e^+e^- \approx 10$ GeV |
|--------------------|-----|-----------------------|-----|-----------------------------|

|                 |    |       |     |                             |
|-----------------|----|-------|-----|-----------------------------|
| 2.8 ± 0.8 ± 0.8 | 46 | ANJOS | 92C | E691 $\gamma$ Be 90–260 GeV |
|-----------------|----|-------|-----|-----------------------------|

|                    |     |           |    |                             |
|--------------------|-----|-----------|----|-----------------------------|
| 1.85 ± 0.26 ± 0.30 | 158 | KINOSHITA | 91 | CLEO $e^+e^- \sim 10.7$ GeV |
|--------------------|-----|-----------|----|-----------------------------|

<sup>1</sup> This value is calculated from numbers in Table 1 of ALBRECHT 92P.

$\Gamma(K_S^0 \eta) / \Gamma_{\text{total}}$   $\Gamma_{94} / \Gamma$

Unseen decay modes of the  $\eta$  are included.

| VALUE (units $10^{-3}$ ) | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-------------|------|---------|
|--------------------------|-------------|------|---------|

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

|                          |       |    |                    |
|--------------------------|-------|----|--------------------|
| $4.42 \pm 0.15 \pm 0.28$ | ASNER | 08 | CLEO See MENDEZ 10 |
|--------------------------|-------|----|--------------------|

$\Gamma(K_S^0 \eta) / [\Gamma(K^- \pi^+) + \Gamma(K^+ \pi^-)]$   $\Gamma_{94} / (\Gamma_{31} + \Gamma_{222})$

Unseen decay modes of the  $\eta$  are included.

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

**12.3 ± 0.8 OUR FIT**

|                         |               |        |    |                            |
|-------------------------|---------------|--------|----|----------------------------|
| <b>12.3 ± 0.3 ± 0.7</b> | $2864 \pm 65$ | MENDEZ | 10 | CLEO $e^+ e^-$ at 3774 MeV |
|-------------------------|---------------|--------|----|----------------------------|

$\Gamma(K_S^0 \eta) / \Gamma(K_S^0 \pi^0)$   $\Gamma_{94} / \Gamma_{33}$

Unseen decay modes of the  $\eta$  are included.

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

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

|                          |              |          |     |                                      |
|--------------------------|--------------|----------|-----|--------------------------------------|
| $0.32 \pm 0.04 \pm 0.03$ | $225 \pm 30$ | PROCARIO | 93B | CLE2 $\eta \rightarrow \gamma\gamma$ |
|--------------------------|--------------|----------|-----|--------------------------------------|

$\Gamma(K_S^0 \eta) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{94} / \Gamma_{35}$

Unseen decay modes of the  $\eta$  are included.

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

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

|                          |             |          |     |   |
|--------------------------|-------------|----------|-----|---|
| $0.14 \pm 0.02 \pm 0.02$ | $80 \pm 12$ | PROCARIO | 93B | CLE2 $\eta \rightarrow \pi^+ \pi^- \pi^0$ |
|--------------------------|-------------|----------|-----|---|

$\Gamma(K_S^0 \omega) / \Gamma_{\text{total}}$   $\Gamma_{95} / \Gamma$

Unseen decay modes of the  $\omega$  are included.

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

**1.11 ± 0.06 OUR FIT**

|                           |       |    |   |
|---------------------------|-------|----|---|
| <b>1.12 ± 0.04 ± 0.05</b> | ASNER | 08 | CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$ , 3.77 GeV |
|---------------------------|-------|----|---|

$\Gamma(K_S^0 \omega) / \Gamma(K^- \pi^+)$   $\Gamma_{95} / \Gamma_{31}$

Unseen decay modes of the  $\omega$  are included.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

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

|                          |          |     |                      |
|--------------------------|----------|-----|----------------------|
| $0.50 \pm 0.18 \pm 0.10$ | ALBRECHT | 89D | ARG $e^+ e^-$ 10 GeV |
|--------------------------|----------|-----|----------------------|

$\Gamma(K_S^0 \omega) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{95} / \Gamma_{35}$

Unseen decay modes of the  $\omega$  are included.

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

**0.389 ± 0.033 OUR FIT** Error includes scale factor of 1.1.

**0.33 ± 0.09 OUR AVERAGE** Error includes scale factor of 1.1.

|                          |    |                       |     |                              |
|--------------------------|----|-----------------------|-----|------------------------------|
| $0.29 \pm 0.08 \pm 0.05$ | 16 | <sup>1</sup> ALBRECHT | 92P | ARG $e^+ e^- \approx 10$ GeV |
|--------------------------|----|-----------------------|-----|------------------------------|

|                          |    |           |    |                              |
|--------------------------|----|-----------|----|------------------------------|
| $0.54 \pm 0.14 \pm 0.16$ | 40 | KINOSHITA | 91 | CLEO $e^+ e^- \sim 10.7$ GeV |
|--------------------------|----|-----------|----|------------------------------|

<sup>1</sup> This value is calculated from numbers in Table 1 of ALBRECHT 92P.

$\Gamma(K_S^0 \omega) / \Gamma(K_S^0 \pi^+ \pi^- \pi^0)$   $\Gamma_{95} / \Gamma_{76}$

Unseen decay modes of the  $\omega$  are included.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

**0.212 ± 0.026 OUR FIT**

|                               |         |     |  |
|-------------------------------|---------|-----|--|
| <b>0.220 ± 0.048 ± 0.0116</b> | COFFMAN | 92B | MRK3 $1281 \pm 45 K^- 2\pi^+ \pi^-$ evts |
|-------------------------------|---------|-----|--|

$$\Gamma(K_S^0 \eta'(958)) / [\Gamma(K^- \pi^+) + \Gamma(K^+ \pi^-)] \quad \Gamma_{96} / (\Gamma_{31} + \Gamma_{222})$$

Unseen decay modes of the  $\eta'(958)$  are included.

| VALUE (units $10^{-2}$ )  | EVTS      | DOCUMENT ID | TECN | COMMENT                    |
|---------------------------|-----------|-------------|------|----------------------------|
| <b>24.1 ± 1.3 OUR FIT</b> |           |             |      |                            |
| <b>24.3 ± 0.8 ± 1.1</b>   | 1321 ± 42 | MENDEZ      | 10   | CLEO $e^+ e^-$ at 3774 MeV |

$$\Gamma(K_S^0 \eta'(958)) / \Gamma(K_S^0 \pi^+ \pi^-) \quad \Gamma_{96} / \Gamma_{35}$$

Unseen decay modes of the  $\eta'(958)$  are included.

| VALUE                          | EVTS | DOCUMENT ID           | TECN | COMMENT  |
|--------------------------------|------|-----------------------|------|--|
| <b>0.333 ± 0.025 OUR FIT</b>   |      |                       |      |  |
| <b>0.32 ± 0.04 OUR AVERAGE</b> |      |                       |      |  |
| 0.31 ± 0.02 ± 0.04             | 594  | PROCARIO              | 93B  | CLE2 $\eta' \rightarrow \eta \pi^+ \pi^-, \rho^0 \gamma$ |
| 0.37 ± 0.13 ± 0.06             | 18   | <sup>1</sup> ALBRECHT | 92P  | ARG $e^+ e^- \approx 10$ GeV                             |

<sup>1</sup> This value is calculated from numbers in Table 1 of ALBRECHT 92P.

$$\Gamma(K^- \pi^+ 2\pi^0) / \Gamma_{\text{total}} \quad \Gamma_{79} / \Gamma$$

| VALUE   | EVTS | DOCUMENT ID              | TECN | COMMENT                       |
|---|------|--------------------------|------|-------------------------------|
| • • • We do not use the following data for averages, fits, limits, etc. • • • |      |                          |      |                               |
| 0.177 ± 0.029   |      | <sup>1</sup> BARLAG      | 92C  | ACCM $\pi^-$ Cu 230 GeV       |
| 0.149 ± 0.037 ± 0.030   | 24   | <sup>2</sup> ADLER       | 88C  | MRK3 $e^+ e^-$ 3.77 GeV       |
| 0.209 <sup>+0.074</sup> <sub>-0.043</sub> ± 0.012                             | 9    | <sup>1</sup> AGUILAR-... | 87F  | HYBR $\pi p, pp$ 360, 400 GeV |

<sup>1</sup> AGUILAR-BENITEZ 87F and BARLAG 92C compute the branching fraction using topological normalization. They do not distinguish the presence of a third  $\pi^0$ , and thus are not included in the average.

<sup>2</sup> ADLER 88C uses an absolute normalization method finding this decay channel opposite a detected  $\bar{D}^0 \rightarrow K^+ \pi^-$  in pure  $D\bar{D}$  events.

$$\Gamma(K^- 2\pi^+ \pi^- \pi^0) / \Gamma(K^- \pi^+) \quad \Gamma_{80} / \Gamma_{31}$$

| VALUE                      | EVTS | DOCUMENT ID           | TECN | COMMENT                      |
|----------------------------|------|-----------------------|------|------------------------------|
| <b>1.08 ± 0.10 OUR FIT</b> |      |                       |      |                              |
| <b>0.98 ± 0.11 ± 0.11</b>  | 225  | <sup>1</sup> ALBRECHT | 92P  | ARG $e^+ e^- \approx 10$ GeV |

<sup>1</sup> This value is calculated from numbers in Table 1 of ALBRECHT 92P.

$$\Gamma(K^- 2\pi^+ \pi^- \pi^0) / \Gamma(K^- 2\pi^+ \pi^-) \quad \Gamma_{80} / \Gamma_{67}$$

| VALUE   | EVTS | DOCUMENT ID | TECN | COMMENT                      |
|---|------|-------------|------|------------------------------|
| <b>0.53 ± 0.05 OUR FIT</b>                    |      |             |      |                              |
| <b>0.56 ± 0.07 OUR AVERAGE</b>                |      |             |      |                              |
| 0.55 ± 0.07 <sup>+0.12</sup> <sub>-0.09</sub> | 167  | KINOSHITA   | 91   | CLEO $e^+ e^- \sim 10.7$ GeV |
| 0.57 ± 0.06 ± 0.05                            | 180  | ANJOS       | 90D  | E691 Photoproduction         |

$$\Gamma(\bar{K}^*(892)^0 \pi^+ \pi^- \pi^0) / \Gamma(K^- 2\pi^+ \pi^- \pi^0) \quad \Gamma_{112} / \Gamma_{80}$$

Unseen decay modes of the  $\bar{K}^*(892)^0$  are included.

| VALUE                     | DOCUMENT ID | TECN | COMMENT              |
|---------------------------|-------------|------|----------------------|
| <b>0.45 ± 0.15 ± 0.15</b> | ANJOS       | 90D  | E691 Photoproduction |

$\Gamma(\bar{K}^*(892)^0 \eta) / \Gamma(K^- \pi^+)$   $\Gamma_{113} / \Gamma_{31}$

Unseen decay modes of the  $\bar{K}^*(892)^0$  and  $\eta$  are included.

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

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

|                                 |    |           |    |                              |
|---------------------------------|----|-----------|----|------------------------------|
| $0.58 \pm 0.19^{+0.24}_{-0.28}$ | 46 | KINOSHITA | 91 | CLEO $e^+ e^- \sim 10.7$ GeV |
|---------------------------------|----|-----------|----|------------------------------|

$\Gamma(\bar{K}^*(892)^0 \eta) / \Gamma(K^- \pi^+ \pi^0)$   $\Gamma_{113} / \Gamma_{50}$

Unseen decay modes of the  $\bar{K}^*(892)^0$  and  $\eta$  are included.

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

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

|                          |     |          |     |  |
|--------------------------|-----|----------|-----|--|
| $0.13 \pm 0.02 \pm 0.03$ | 214 | PROCARIO | 93B | CLE2 $\bar{K}^{*0} \eta \rightarrow K^- \pi^+ / \gamma \gamma$ |
|--------------------------|-----|----------|-----|--|

$\Gamma(K_S^0 \eta \pi^0) / \Gamma(K_S^0 \pi^0)$   $\Gamma_{84} / \Gamma_{33}$

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

|                          |              |                    |    |                               |
|--------------------------|--------------|--------------------|----|-------------------------------|
| $0.46 \pm 0.07 \pm 0.06$ | $155 \pm 22$ | <sup>1</sup> RUBIN | 04 | CLEO $e^+ e^- \approx 10$ GeV |
|--------------------------|--------------|--------------------|----|-------------------------------|

<sup>1</sup> The  $\eta$  here is detected in its  $\gamma \gamma$  mode, but other  $\eta$  modes are included in the value given.

$\Gamma(K_S^0 a_0(980), a_0(980) \rightarrow \eta \pi^0) / \Gamma(K_S^0 \eta \pi^0)$   $\Gamma_{85} / \Gamma_{84}$

This is the "fit fraction" from the Dalitz-plot analysis, with interference.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

|                          |                    |    |                           |
|--------------------------|--------------------|----|---------------------------|
| $1.19 \pm 0.09 \pm 0.26$ | <sup>1</sup> RUBIN | 04 | CLEO Dalitz fit, 155 evts |
|--------------------------|--------------------|----|---------------------------|

<sup>1</sup> In addition to  $K_S^0 a_0(980)$  and  $\bar{K}^*(892)^0 \eta$  modes, RUBIN 04 finds a fit fraction of  $0.246 \pm 0.092 \pm 0.091$  for other, undetermined modes.

$\Gamma(\bar{K}^*(892)^0 \eta, \bar{K}^*(892)^0 \rightarrow K_S^0 \pi^0) / \Gamma(K_S^0 \eta \pi^0)$   $\Gamma_{86} / \Gamma_{84}$

This is the "fit fraction" from the Dalitz-plot analysis, with interference.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

|                             |                    |    |                           |
|-----------------------------|--------------------|----|---------------------------|
| $0.293 \pm 0.062 \pm 0.035$ | <sup>1</sup> RUBIN | 04 | CLEO Dalitz fit, 155 evts |
|-----------------------------|--------------------|----|---------------------------|

<sup>1</sup> See the note on RUBIN 04 in the preceding data block.

$\Gamma(K^- \pi^+ \omega) / \Gamma(K^- \pi^+)$   $\Gamma_{114} / \Gamma_{31}$

Unseen decay modes of the  $\omega$  are included.

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

|                          |    |                       |     |                              |
|--------------------------|----|-----------------------|-----|------------------------------|
| $0.78 \pm 0.12 \pm 0.10$ | 99 | <sup>1</sup> ALBRECHT | 92P | ARG $e^+ e^- \approx 10$ GeV |
|--------------------------|----|-----------------------|-----|------------------------------|

<sup>1</sup> This value is calculated from numbers in Table 1 of ALBRECHT 92P.

$\Gamma(\bar{K}^*(892)^0 \omega) / \Gamma(K^- \pi^+)$   $\Gamma_{115} / \Gamma_{31}$

Unseen decay modes of the  $\bar{K}^*(892)^0$  and  $\omega$  are included.

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

|                          |    |                       |     |                              |
|--------------------------|----|-----------------------|-----|------------------------------|
| $0.28 \pm 0.11 \pm 0.04$ | 17 | <sup>1</sup> ALBRECHT | 92P | ARG $e^+ e^- \approx 10$ GeV |
|--------------------------|----|-----------------------|-----|------------------------------|

<sup>1</sup> This value is calculated from numbers in Table 1 of ALBRECHT 92P.

$\Gamma(K^- \pi^+ \eta'(958)) / \Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{116} / \Gamma_{67}$

Unseen decay modes of the  $\eta'(958)$  are included.

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

|                             |     |          |     |  |
|-----------------------------|-----|----------|-----|--|
| $0.093 \pm 0.014 \pm 0.019$ | 286 | PROCARIO | 93B | CLE2 $\eta' \rightarrow \eta \pi^+ \pi^-, \rho^0 \gamma$ |
|-----------------------------|-----|----------|-----|--|

$\Gamma(\bar{K}^*(892)^0 \eta'(958))/\Gamma(K^- \pi^+ \eta'(958))$   $\Gamma_{117}/\Gamma_{116}$

Unseen decay modes of the  $\bar{K}^*(892)^0$  are included.

| VALUE | CL% | DOCUMENT ID | TECN     |
|-------|-----|-------------|----------|
| <0.15 | 90  | PROCARIO    | 93B CLE2 |

$\Gamma(K_S^0 2\pi^+ 2\pi^-)/\Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{87}/\Gamma_{35}$

| VALUE                    | EVTS      | DOCUMENT ID | TECN     | COMMENT                                    |
|--------------------------|-----------|-------------|----------|--|
| <b>0.095±0.005±0.007</b> | 1283 ± 57 | LINK        | 04D FOCS | $\gamma A, \bar{E}_\gamma \approx 180$ GeV |

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

|                  |    |                       |          |                            |
|------------------|----|-----------------------|----------|----------------------------|
| 0.07 ±0.02 ±0.01 | 11 | <sup>1</sup> ALBRECHT | 92P ARG  | $e^+ e^- \approx 10$ GeV   |
| 0.149±0.026      | 56 | AMMAR                 | 91 CLEO  | $e^+ e^- \approx 10.5$ GeV |
| 0.18 ±0.07 ±0.04 | 6  | ANJOS                 | 90D E691 | Photoproduction            |

<sup>1</sup> This value is calculated from numbers in Table 1 of ALBRECHT 92P.

$\Gamma(K_S^0 \rho^0 \pi^+ \pi^-, \text{no } K^*(892)^-)/\Gamma(K_S^0 2\pi^+ 2\pi^-)$   $\Gamma_{88}/\Gamma_{87}$

| VALUE                 | DOCUMENT ID | TECN     | COMMENT                                    |
|-----------------------|-------------|----------|--|
| <b>0.40±0.24±0.07</b> | LINK        | 04D FOCS | $\gamma A, \bar{E}_\gamma \approx 180$ GeV |

$\Gamma(K^*(892)^- 2\pi^+ \pi^-, K^*(892)^- \rightarrow K_S^0 \pi^-, \text{no } \rho^0)/\Gamma(K_S^0 2\pi^+ 2\pi^-)$   $\Gamma_{89}/\Gamma_{87}$

| VALUE                 | DOCUMENT ID | TECN     | COMMENT                                    |
|-----------------------|-------------|----------|--|
| <b>0.17±0.28±0.02</b> | LINK        | 04D FOCS | $\gamma A, \bar{E}_\gamma \approx 180$ GeV |

$\Gamma(K^*(892)^- \rho^0 \pi^+, K^*(892)^- \rightarrow K_S^0 \pi^-)/\Gamma(K_S^0 2\pi^+ 2\pi^-)$   $\Gamma_{90}/\Gamma_{87}$

| VALUE                 | DOCUMENT ID | TECN     | COMMENT                                    |
|-----------------------|-------------|----------|--|
| <b>0.60±0.21±0.09</b> | LINK        | 04D FOCS | $\gamma A, \bar{E}_\gamma \approx 180$ GeV |

$\Gamma(K_S^0 2\pi^+ 2\pi^- \text{ nonresonant})/\Gamma(K_S^0 2\pi^+ 2\pi^-)$   $\Gamma_{91}/\Gamma_{87}$

| VALUE | CL% | DOCUMENT ID | TECN     | COMMENT                                    |
|-------|-----|-------------|----------|--|
| <0.46 | 90  | LINK        | 04D FOCS | $\gamma A, \bar{E}_\gamma \approx 180$ GeV |

$\Gamma(K^- 3\pi^+ 2\pi^-)/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{93}/\Gamma_{67}$

| VALUE (units 10 <sup>-3</sup> ) | EVTS    | DOCUMENT ID | TECN     | COMMENT                                    |
|---------------------------------|---------|-------------|----------|--|
| <b>2.70±0.58±0.38</b>           | 48 ± 10 | LINK        | 04B FOCS | $\gamma A, \bar{E}_\gamma \approx 180$ GeV |

———— Hadronic modes with three K's ————

$\Gamma(K_S^0 K^+ K^-)/\Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{118}/\Gamma_{35}$

| VALUE                    | EVTS    | DOCUMENT ID | TECN     | COMMENT                      |
|--------------------------|---------|-------------|----------|------------------------------|
| <b>0.158±0.001±0.005</b> | 14k±116 | AUBERT,B    | 05J BABR | $e^+ e^- \approx \gamma(4S)$ |

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

|                  |     |          |          |                                       |
|------------------|-----|----------|----------|---------------------------------------|
| 0.20 ±0.05 ±0.04 | 47  | FRABETTI | 92B E687 | $\gamma Be, \bar{E}_\gamma = 221$ GeV |
| 0.170±0.022      | 136 | AMMAR    | 91 CLEO  | $e^+ e^- \approx 10.5$ GeV            |
| 0.24 ±0.08       |     | BEBEK    | 86 CLEO  | $e^+ e^-$ near $\gamma(4S)$           |
| 0.185±0.055      | 52  | ALBRECHT | 85B ARG  | $e^+ e^- 10$ GeV                      |

$\Gamma(K_S^0 a_0(980)^0, a_0^0 \rightarrow K^+ K^-)/\Gamma(K_S^0 K^+ K^-)$   $\Gamma_{119}/\Gamma_{118}$

This is the "fit fraction" from the Dalitz-plot analysis, with interference.

| VALUE                    | DOCUMENT ID | TECN     | COMMENT                      |
|--------------------------|-------------|----------|------------------------------|
| <b>0.664±0.016±0.070</b> | AUBERT,B    | 05J BABR | Dalitz fit, 12540 ± 112 evts |

$$\Gamma(K^- a_0(980)^+, a_0^+ \rightarrow K^+ K_S^0) / \Gamma(K_S^0 K^+ K^-) \quad \Gamma_{120} / \Gamma_{118}$$

This is the "fit fraction" from the Dalitz-plot analysis, with interference.

| VALUE                        | DOCUMENT ID | TECN | COMMENT                           |
|------------------------------|-------------|------|-----------------------------------|
| <b>0.134 ± 0.011 ± 0.037</b> | AUBERT,B    | 05J  | BABR Dalitz fit, 12540 ± 112 evts |

$$\Gamma(K^+ a_0(980)^-, a_0^- \rightarrow K^- K_S^0) / \Gamma(K_S^0 K^+ K^-) \quad \Gamma_{121} / \Gamma_{118}$$

This is a doubly Cabibbo-suppressed mode.

| VALUE            | CL% | DOCUMENT ID | TECN | COMMENT                           |
|------------------|-----|-------------|------|-----------------------------------|
| <b>&lt;0.025</b> | 95  | AUBERT,B    | 05J  | BABR Dalitz fit, 12540 ± 112 evts |

$$\Gamma(K_S^0 f_0(980), f_0 \rightarrow K^+ K^-) / \Gamma(K_S^0 K^+ K^-) \quad \Gamma_{122} / \Gamma_{118}$$

| VALUE            | CL% | DOCUMENT ID | TECN | COMMENT                           |
|------------------|-----|-------------|------|-----------------------------------|
| <b>&lt;0.021</b> | 95  | AUBERT,B    | 05J  | BABR Dalitz fit, 12540 ± 112 evts |

$$\Gamma(K_S^0 \phi, \phi \rightarrow K^+ K^-) / \Gamma(K_S^0 K^+ K^-) \quad \Gamma_{123} / \Gamma_{118}$$

This is the "fit fraction" from the Dalitz-plot analysis, with interference.

| VALUE                        | DOCUMENT ID | TECN | COMMENT                           |
|------------------------------|-------------|------|-----------------------------------|
| <b>0.459 ± 0.007 ± 0.007</b> | AUBERT,B    | 05J  | BABR Dalitz fit, 12540 ± 112 evts |

$$\Gamma(K_S^0 f_0(1370), f_0 \rightarrow K^+ K^-) / \Gamma(K_S^0 K^+ K^-) \quad \Gamma_{124} / \Gamma_{118}$$

This is the "fit fraction" from the Dalitz-plot analysis, with interference.

| VALUE                        | DOCUMENT ID           | TECN | COMMENT                           |
|------------------------------|-----------------------|------|-----------------------------------|
| <b>0.038 ± 0.007 ± 0.023</b> | <sup>1</sup> AUBERT,B | 05J  | BABR Dalitz fit, 12540 ± 112 evts |

<sup>1</sup> AUBERT,B 05J calls the mode  $K_S^0 f_0(1400)$ , but insofar as it is seen here at all, it is certainly the same as  $f_0(1370)$ .

$$\Gamma(3K_S^0) / \Gamma(K_S^0 \pi^+ \pi^-) \quad \Gamma_{125} / \Gamma_{35}$$

| VALUE (units 10 <sup>-2</sup> ) | EVTS     | DOCUMENT ID | TECN     | COMMENT                                       |
|---------------------------------|----------|-------------|----------|---|
| <b>3.2 ± 0.4 OUR AVERAGE</b>    |          |             |          |   |
| 3.58 ± 0.54 ± 0.52              | 170 ± 26 | LINK        | 05A FOCS | $\gamma$ Be, $\bar{E}_\gamma \approx 180$ GeV |
| 2.78 ± 0.38 ± 0.48              | 61       | ASNER       | 96B CLE2 | $e^+ e^- \approx \Upsilon(4S)$                |
| 7.0 ± 2.4 ± 1.2                 | 10 ± 3   | FRABETTI    | 94J E687 | $\gamma$ Be, $\bar{E}_\gamma = 220$ GeV       |
| 3.2 ± 1.0                       | 22       | AMMAR       | 91 CLEO  | $e^+ e^- \approx 10.5$ GeV                    |
| 3.4 ± 1.4 ± 1.0                 | 5        | ALBRECHT    | 90C ARG  | $e^+ e^- \approx 10$ GeV                      |

$$\Gamma(K^+ 2K^- \pi^+) / \Gamma(K^- 2\pi^+ \pi^-) \quad \Gamma_{126} / \Gamma_{67}$$

| VALUE                              | EVTS | DOCUMENT ID | TECN     | COMMENT                                       |
|------------------------------------|------|-------------|----------|---|
| <b>0.0027 ± 0.0004 OUR AVERAGE</b> |      |             |          | Error includes scale factor of 1.1.           |
| 0.00257 ± 0.00034 ± 0.00024        | 143  | LINK        | 03G FOCS | $\gamma$ A, $\bar{E}_\gamma \approx 180$ GeV  |
| 0.0054 ± 0.0016 ± 0.0008           | 18   | AITALA      | 01D E791 | $\pi^-$ A, 500 GeV                            |
| 0.0028 ± 0.0007 ± 0.0001           | 20   | FRABETTI    | 95C E687 | $\gamma$ Be, $\bar{E}_\gamma \approx 200$ GeV |

$$\Gamma(\phi \bar{K}^*(892)^0, \phi \rightarrow K^+ K^-, \bar{K}^*(892)^0 \rightarrow K^- \pi^+) / \Gamma(K^+ 2K^- \pi^+) \quad \Gamma_{129} / \Gamma_{126}$$

| VALUE                     | DOCUMENT ID | TECN | COMMENT   |
|---------------------------|-------------|------|---|
| <b>0.48 ± 0.06 ± 0.01</b> | LINK        | 03G  | FOCS $\gamma$ A, $\bar{E}_\gamma \approx 180$ GeV |



$\Gamma(K^- \pi^+ \phi, \phi \rightarrow K^+ K^-) / \Gamma(K^+ 2K^- \pi^+)$   $\Gamma_{128} / \Gamma_{126}$

| VALUE                     | DOCUMENT ID | TECN | COMMENT   |
|---------------------------|-------------|------|---|
| <b>0.18 ± 0.06 ± 0.04</b> | LINK        | 03G  | FOCS $\gamma$ A, $\bar{E}_\gamma \approx 180$ GeV |

$\Gamma(K^+ K^- \bar{K}^*(892)^0, \bar{K}^*(892)^0 \rightarrow K^- \pi^+) / \Gamma(K^+ 2K^- \pi^+)$   $\Gamma_{127} / \Gamma_{126}$

| VALUE                     | DOCUMENT ID | TECN | COMMENT   |
|---------------------------|-------------|------|---|
| <b>0.20 ± 0.07 ± 0.02</b> | LINK        | 03G  | FOCS $\gamma$ A, $\bar{E}_\gamma \approx 180$ GeV |

$\Gamma(K^+ 2K^- \pi^+ \text{nonresonant}) / \Gamma(K^+ 2K^- \pi^+)$   $\Gamma_{130} / \Gamma_{126}$

| VALUE                     | DOCUMENT ID | TECN | COMMENT   |
|---------------------------|-------------|------|---|
| <b>0.15 ± 0.06 ± 0.02</b> | LINK        | 03G  | FOCS $\gamma$ A, $\bar{E}_\gamma \approx 180$ GeV |

$\Gamma(2K_S^0 K^\pm \pi^\mp) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{131} / \Gamma_{35}$

| VALUE (units $10^{-2}$ )  | EVTS    | DOCUMENT ID | TECN | COMMENT  |
|---------------------------|---------|-------------|------|--|
| <b>2.12 ± 0.38 ± 0.20</b> | 57 ± 10 | LINK        | 05A  | FOCS $\gamma$ Be, $\bar{E}_\gamma \approx 180$ GeV |

————— Pionic modes —————

$\Gamma(\pi^+ \pi^-) / \Gamma(K^- \pi^+)$   $\Gamma_{132} / \Gamma_{31}$

| VALUE (units $10^{-2}$ )  | EVTS      | DOCUMENT ID | TECN | COMMENT   |
|---|-----------|-------------|------|---|
| <b>3.62 ± 0.05 OUR FIT</b>  |           |             |      |   |
| <b>3.59 ± 0.06 OUR AVERAGE</b>  |           |             |      |   |
| 3.594 ± 0.054 ± 0.040   | 7334 ± 97 | ACOSTA      | 05C  | CDF $p\bar{p}$ , $\sqrt{s} = 1.96$ TeV            |
| 3.53 ± 0.12 ± 0.06  | 3453      | LINK        | 03   | FOCS $\gamma$ A, $\bar{E}_\gamma \approx 180$ GeV |
| 3.51 ± 0.16 ± 0.17  | 710       | CSORNA      | 02   | CLE2 $e^+ e^- \approx \Upsilon(4S)$               |
| 4.0 ± 0.2 ± 0.3   | 2043      | AITALA      | 98C  | E791 $\pi^-$ A, 500 GeV                           |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |           |             |      |   |
| 3.62 ± 0.10 ± 0.08  | 2085 ± 54 | RUBIN       | 06   | CLEO See MENDEZ 10                                |
| 3.4 ± 0.7 ± 0.1   | 76 ± 15   | ABLIKIM     | 05F  | BES $e^+ e^- \approx \psi(3770)$                  |
| 4.3 ± 0.7 ± 0.3   | 177       | FRABETTI    | 94C  | E687 $\gamma$ Be $\bar{E}_\gamma = 220$ GeV       |
| 3.48 ± 0.30 ± 0.23  | 227       | SELEN       | 93   | CLE2 $e^+ e^- \approx \Upsilon(4S)$               |
| 5.5 ± 0.8 ± 0.5   | 120       | ANJOS       | 91D  | E691 Photoproduction                              |
| 5.0 ± 0.7 ± 0.5   | 110       | ALEXANDER   | 90   | CLEO $e^+ e^-$ 10.5–11 GeV                        |

$\Gamma(\pi^+ \pi^-) / [\Gamma(K^- \pi^+) + \Gamma(K^+ \pi^-)]$   $\Gamma_{132} / (\Gamma_{31} + \Gamma_{222})$

| VALUE (units $10^{-2}$ )   | EVTS      | DOCUMENT ID | TECN | COMMENT                    |
|----------------------------|-----------|-------------|------|----------------------------|
| <b>3.60 ± 0.05 OUR FIT</b> |           |             |      |                            |
| <b>3.70 ± 0.06 ± 0.09</b>  | 6210 ± 93 | MENDEZ      | 10   | CLEO $e^+ e^-$ at 3774 MeV |

$\Gamma(2\pi^0) / \Gamma_{\text{total}}$   $\Gamma_{133} / \Gamma$

| VALUE (units $10^{-4}$ )   | EVTS | DOCUMENT ID | TECN | COMMENT                          |
|----------------------------|------|-------------|------|----------------------------------|
| <b>8.26 ± 0.35 OUR FIT</b> |      |             |      |                                  |
| <b>8.4 ± 0.1 ± 0.5</b>     | 26k  | LEES        | 12L  | BABR $e^+ e^- \approx 10.58$ GeV |

$\Gamma(2\pi^0) / \Gamma(K^- \pi^+)$   $\Gamma_{133} / \Gamma_{31}$

| VALUE (units $10^{-2}$ )  | EVTS     | DOCUMENT ID | TECN | COMMENT                                 |
|---|----------|-------------|------|---|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |          |             |      |   |
| 2.05 ± 0.13 ± 0.16  | 499 ± 32 | RUBIN       | 06   | CLEO See MENDEZ 10                      |
| 2.2 ± 0.4 ± 0.4   | 40       | SELEN       | 93   | CLE2 $e^+ e^- \rightarrow \Upsilon(4S)$ |

$\Gamma(2\pi^0)/[\Gamma(K^-\pi^+) + \Gamma(K^+\pi^-)]$   $\Gamma_{133}/(\Gamma_{31}+\Gamma_{222})$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                                 |
|--------------------------------------|-------------|--------------------|-------------|--|
| <b>2.09±0.09 OUR FIT</b>             |             |                    |             |  |
| <b>2.06±0.07±0.10</b>                | 1567 ± 54   | MENDEZ             | 10          | CLEO e <sup>+</sup> e <sup>-</sup> at 3774 MeV |

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma(K^-\pi^+)$   $\Gamma_{134}/\Gamma_{31}$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>EVTS</u>                         | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                                     |
|--------------------------------------|-------------------------------------|--------------------|-------------|--|
| <b>37.5±2.3 OUR FIT</b>              | Error includes scale factor of 3.0. |                    |             |  |
| <b>34.4±0.5±1.2</b>                  | 11k±164                             | RUBIN              | 06          | CLEO e <sup>+</sup> e <sup>-</sup> at $\psi(3770)$ |

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma(K^-\pi^+\pi^0)$   $\Gamma_{134}/\Gamma_{50}$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>EVTS</u>                         | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>  |
|--------------------------------------|-------------------------------------|--------------------|-------------|---|
| <b>10.33±0.25 OUR FIT</b>            | Error includes scale factor of 2.3. |                    |             |   |
| <b>10.41±0.23 OUR AVERAGE</b>        | Error includes scale factor of 2.0. |                    |             |   |
| 10.12±0.04±0.18                      | 123k±490                            | ARINSTEIN          | 08          | BELL e <sup>+</sup> e <sup>-</sup> $\approx \Upsilon(4S)$ |
| 10.59±0.06±0.13                      | 60k±343                             | AUBERT,B           | 06x         | BABR e <sup>+</sup> e <sup>-</sup> $\approx \Upsilon(4S)$ |

$\Gamma(\rho^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$   $\Gamma_{135}/\Gamma_{134}$

This is the "fit fraction" from the Dalitz-plot analysis, with interference. See GASPERO 08 and BHATTACHARYA 10A for isospin decompositions of the  $D^0 \rightarrow \pi^+\pi^0\pi^-$  Dalitz plot, both based on the amplitudes of AUBERT 07BJ. They quantify the conclusion that the final state is dominantly isospin 0.

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                                 |
|--------------------------------------|--------------------|-------------|--|
| <b>68.1±0.6 OUR AVERAGE</b>          |                    |             |  |
| 67.8±0.0±0.6                         | AUBERT             | 07BJ        | BABR Dalitz fit, 45k events                    |
| 76.3±1.9±2.5                         | CRONIN-HEN..05     | CLEO        | e <sup>+</sup> e <sup>-</sup> $\approx 10$ GeV |

$\Gamma(\rho^0\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$   $\Gamma_{136}/\Gamma_{134}$

This is the "fit fraction" from the Dalitz-plot analysis, with interference.

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                                 |
|--------------------------------------|--------------------|-------------|--|
| <b>25.9±1.1 OUR AVERAGE</b>          |                    |             |  |
| 26.2±0.5±1.1                         | AUBERT             | 07BJ        | BABR Dalitz fit, 45k events                    |
| 24.4±2.0±2.1                         | CRONIN-HEN..05     | CLEO        | e <sup>+</sup> e <sup>-</sup> $\approx 10$ GeV |

$\Gamma(\rho^-\pi^+)/\Gamma(\pi^+\pi^-\pi^0)$   $\Gamma_{137}/\Gamma_{134}$

This is the "fit fraction" from the Dalitz-plot analysis, with interference.

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                                 |
|--------------------------------------|--------------------|-------------|--|
| <b>34.6±0.8 OUR AVERAGE</b>          |                    |             |  |
| 34.6±0.8±0.3                         | AUBERT             | 07BJ        | BABR Dalitz fit, 45k events                    |
| 34.5±2.4±1.3                         | CRONIN-HEN..05     | CLEO        | e <sup>+</sup> e <sup>-</sup> $\approx 10$ GeV |

$\Gamma(\rho(1450)^+\pi^-, \rho(1450)^+ \rightarrow \pi^+\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$   $\Gamma_{138}/\Gamma_{134}$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>              |
|--------------------------------------|--------------------|-------------|-----------------------------|
| <b>0.11±0.07±0.12</b>                | AUBERT             | 07BJ        | BABR Dalitz fit, 45k events |

$\Gamma(\rho(1450)^0\pi^0, \rho(1450)^0 \rightarrow \pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$   $\Gamma_{139}/\Gamma_{134}$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>              |
|--------------------------------------|--------------------|-------------|-----------------------------|
| <b>0.30±0.11±0.07</b>                | AUBERT             | 07BJ        | BABR Dalitz fit, 45k events |

$$\Gamma(\rho(1450)^- \pi^+, \rho(1450)^- \rightarrow \pi^- \pi^0) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{140} / \Gamma_{134}$$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>         |
|--------------------------------------|--------------------|-------------|------------------------|
| <b>1.79 ± 0.22 ± 0.12</b>            | AUBERT             | 07BJ BABR   | Dalitz fit, 45k events |

$$\Gamma(\rho(1700)^+ \pi^-, \rho(1700)^+ \rightarrow \pi^+ \pi^0) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{141} / \Gamma_{134}$$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>         |
|--------------------------------------|--------------------|-------------|------------------------|
| <b>4.1 ± 0.7 ± 0.7</b>               | AUBERT             | 07BJ BABR   | Dalitz fit, 45k events |

$$\Gamma(\rho(1700)^0 \pi^0, \rho(1700)^0 \rightarrow \pi^+ \pi^-) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{142} / \Gamma_{134}$$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>         |
|--------------------------------------|--------------------|-------------|------------------------|
| <b>5.0 ± 0.6 ± 1.0</b>               | AUBERT             | 07BJ BABR   | Dalitz fit, 45k events |

$$\Gamma(\rho(1700)^- \pi^+, \rho(1700)^- \rightarrow \pi^- \pi^0) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{143} / \Gamma_{134}$$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>         |
|--------------------------------------|--------------------|-------------|------------------------|
| <b>3.2 ± 0.4 ± 0.6</b>               | AUBERT             | 07BJ BABR   | Dalitz fit, 45k events |

$$\Gamma(f_0(980) \pi^0, f_0(980) \rightarrow \pi^+ \pi^-) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{144} / \Gamma_{134}$$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>         |
|--------------------------------------|------------|--------------------|-------------|------------------------|
| <b>0.25 ± 0.04 ± 0.04</b>            |            | AUBERT             | 07BJ BABR   | Dalitz fit, 45k events |

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

<0.026                      95                      <sup>1</sup> CRONIN-HEN..05      CLEO      e<sup>+</sup> e<sup>-</sup> ≈ 10 GeV

<sup>1</sup> The CRONIN-HENNESSY 05 fit here includes, in addition to the three  $\rho\pi$  charged states, only the  $f_0(980)\pi^0$  mode. See also the next entries for limits obtained in the same way for the  $f_0(500)\pi^0$  mode and for an  $S$ -wave  $\pi^+\pi^-$  parametrized using a  $K$ -matrix. Our  $\rho\pi$  branching ratios, given above, use the fit with the  $K$ -matrix  $S$  wave.

$$\Gamma(f_0(500) \pi^0, f_0(500) \rightarrow \pi^+ \pi^-) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{145} / \Gamma_{134}$$

The  $f_0(500)$  is the  $\sigma$ .

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>         |
|--------------------------------------|------------|--------------------|-------------|------------------------|
| <b>0.82 ± 0.10 ± 0.10</b>            |            | AUBERT             | 07BJ BABR   | Dalitz fit, 45k events |

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

<0.21                      95                      <sup>1</sup> CRONIN-HEN..05      CLEO      e<sup>+</sup> e<sup>-</sup> ≈ 10 GeV

<sup>1</sup> See the note on CRONIN-HENNESSY 05 in the proceeding data block.

$$\Gamma((\pi^+ \pi^-)_{S\text{-wave}} \pi^0) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{146} / \Gamma_{134}$$

| <u>VALUE</u> | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------|------------|--------------------|-------------|----------------|
|              |            |                    |             |                |

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

<0.019                      95                      <sup>1</sup> CRONIN-HEN..05      CLEO      e<sup>+</sup> e<sup>-</sup> ≈ 10 GeV

<sup>1</sup> See the note on CRONIN-HENNESSY 05 two data blocks up.

$$\Gamma(f_0(1370) \pi^0, f_0(1370) \rightarrow \pi^+ \pi^-) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{147} / \Gamma_{134}$$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>         |
|--------------------------------------|--------------------|-------------|------------------------|
| <b>0.37 ± 0.11 ± 0.09</b>            | AUBERT             | 07BJ BABR   | Dalitz fit, 45k events |

$$\Gamma(f_0(1500) \pi^0, f_0(1500) \rightarrow \pi^+ \pi^-) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{148} / \Gamma_{134}$$

| <u>VALUE (units 10<sup>-2</sup>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>         |
|--------------------------------------|--------------------|-------------|------------------------|
| <b>0.39 ± 0.08 ± 0.07</b>            | AUBERT             | 07BJ BABR   | Dalitz fit, 45k events |

$\Gamma(f_0(1710)\pi^0, f_0(1710) \rightarrow \pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$   $\Gamma_{149}/\Gamma_{134}$

| VALUE (units $10^{-2}$ ) | DOCUMENT ID | TECN      | COMMENT                |
|--------------------------|-------------|-----------|------------------------|
| <b>0.31±0.07±0.08</b>    | AUBERT      | 07BJ BABR | Dalitz fit, 45k events |

$\Gamma(f_2(1270)\pi^0, f_2(1270) \rightarrow \pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$   $\Gamma_{150}/\Gamma_{134}$

| VALUE (units $10^{-2}$ ) | DOCUMENT ID | TECN      | COMMENT                |
|--------------------------|-------------|-----------|------------------------|
| <b>1.32±0.08±0.10</b>    | AUBERT      | 07BJ BABR | Dalitz fit, 45k events |

$\Gamma(\pi^+\pi^-\pi^0 \text{ nonresonant})/\Gamma(\pi^+\pi^-\pi^0)$   $\Gamma_{151}/\Gamma_{134}$

| VALUE (units $10^{-2}$ ) | DOCUMENT ID | TECN      | COMMENT                |
|--------------------------|-------------|-----------|------------------------|
| <b>0.84±0.21±0.12</b>    | AUBERT      | 07BJ BABR | Dalitz fit, 45k events |

$\Gamma(3\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{152}/\Gamma$

| VALUE                            | CL% | DOCUMENT ID | TECN    | COMMENT                  |
|----------------------------------|-----|-------------|---------|--------------------------|
| <b>&lt;3.5 × 10<sup>-4</sup></b> | 90  | RUBIN       | 06 CLEO | $e^+e^-$ at $\psi(3770)$ |

$\Gamma(2\pi^+2\pi^-)/\Gamma(K^-\pi^+)$   $\Gamma_{153}/\Gamma_{31}$

| VALUE (units $10^{-2}$ ) | EVTS                                | DOCUMENT ID | TECN    | COMMENT                  |
|--------------------------|-------------------------------------|-------------|---------|--------------------------|
| <b>19.0±0.6 OUR FIT</b>  | Error includes scale factor of 1.1. |             |         |                          |
| <b>19.1±0.4±0.6</b>      | 7331 ± 130                          | RUBIN       | 06 CLEO | $e^+e^-$ at $\psi(3770)$ |

$\Gamma(2\pi^+2\pi^-)/\Gamma(K^-2\pi^+\pi^-)$   $\Gamma_{153}/\Gamma_{67}$

| VALUE (units $10^{-2}$ )  | EVTS                                | DOCUMENT ID | TECN     | COMMENT   |
|---|-------------------------------------|-------------|----------|---|
| <b>9.24±0.23 OUR FIT</b>  | Error includes scale factor of 1.1. |             |          |   |
| <b>9.20±0.26 OUR AVERAGE</b>  |                                     |             |          |   |
| 9.14±0.18±0.22  | 6360 ± 115                          | LINK        | 07A FOCS | $\gamma\text{Be}, \bar{E}_\gamma \approx 180 \text{ GeV}$ |
| 7.9 ± 1.8 ± 0.5   | 162                                 | ABLIKIM     | 05F BES  | $e^+e^- \approx \psi(3770)$                               |
| 9.5 ± 0.7 ± 0.2   | 814                                 | FRABETTI    | 95C E687 | $\gamma\text{Be}, \bar{E}_\gamma \approx 200 \text{ GeV}$ |
| 10.2 ± 1.3  | 345                                 | AMMAR       | 91 CLEO  | $e^+e^- \approx 10.5 \text{ GeV}$                         |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |                                     |             |          |   |
| 11.5 ± 2.3 ± 1.6  | 64                                  | ADAMOVICH   | 92 OMEG  | $\pi^-$ 340 GeV   |
| 10.8 ± 2.4 ± 0.8  | 79                                  | FRABETTI    | 92 E687  | $\gamma\text{Be}$   |
| 9.6 ± 1.8 ± 0.7   | 66                                  | ANJOS       | 91 E691  | $\gamma\text{Be}$ 80–240 GeV                              |

$\Gamma(a_1(1260)^+\pi^-, a_1^+ \rightarrow 2\pi^+\pi^- \text{ total})/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{154}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| VALUE (units $10^{-2}$ ) | DOCUMENT ID | TECN     | COMMENT                                |
|--------------------------|-------------|----------|--|
| <b>60.0±3.0±2.4</b>      | LINK        | 07A FOCS | 4-body fit, $\approx 5.7\text{k}$ evts |

$\Gamma(a_1(1260)^+\pi^-, a_1^+ \rightarrow \rho^0\pi^+ \text{ S-wave})/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{155}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| VALUE (units $10^{-2}$ ) | DOCUMENT ID | TECN     | COMMENT                                |
|--------------------------|-------------|----------|--|
| <b>43.3±2.5±1.9</b>      | LINK        | 07A FOCS | 4-body fit, $\approx 5.7\text{k}$ evts |

$\Gamma(a_1(1260)^+\pi^-, a_1^+ \rightarrow \rho^0\pi^+ \text{ D-wave})/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{156}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| VALUE (units $10^{-2}$ ) | DOCUMENT ID | TECN     | COMMENT                                |
|--------------------------|-------------|----------|--|
| <b>2.5±0.5±0.4</b>       | LINK        | 07A FOCS | 4-body fit, $\approx 5.7\text{k}$ evts |

$\Gamma(a_1(1260)^+\pi^-, a_1^+ \rightarrow \sigma\pi^+)/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{157}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                       |
|---|--------------------|-------------|--------------------------------------|
| <b>8.3±0.7±0.6</b>                        | LINK               | 07A         | FOCS 4-body fit, $\approx 5.7k$ evts |

$\Gamma(2\rho^0 \text{ total})/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{158}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                       |
|---|--------------------|-------------|--------------------------------------|
| <b>24.5±1.3±1.0</b>                       | LINK               | 07A         | FOCS 4-body fit, $\approx 5.7k$ evts |

$\Gamma(2\rho^0, \text{ parallel helicities})/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{159}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                       |
|---|--------------------|-------------|--------------------------------------|
| <b>1.1±0.3±0.3</b>                        | LINK               | 07A         | FOCS 4-body fit, $\approx 5.7k$ evts |

$\Gamma(2\rho^0, \text{ perpendicular helicities})/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{160}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                       |
|---|--------------------|-------------|--------------------------------------|
| <b>6.4±0.6±0.5</b>                        | LINK               | 07A         | FOCS 4-body fit, $\approx 5.7k$ evts |

$\Gamma(2\rho^0, \text{ longitudinal helicities})/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{161}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                       |
|---|--------------------|-------------|--------------------------------------|
| <b>16.8±1.0±0.8</b>                       | LINK               | 07A         | FOCS 4-body fit, $\approx 5.7k$ evts |

$\Gamma(\text{Resonant } (\pi^+\pi^-\pi^+\pi^- \text{ 3-body total})/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{162}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                       |
|---|--------------------|-------------|--------------------------------------|
| <b>20.0±1.2±1.0</b>                       | LINK               | 07A         | FOCS 4-body fit, $\approx 5.7k$ evts |

$\Gamma(\sigma\pi^+\pi^-)/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{163}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                       |
|---|--------------------|-------------|--------------------------------------|
| <b>8.2±0.9±0.7</b>                        | LINK               | 07A         | FOCS 4-body fit, $\approx 5.7k$ evts |

$\Gamma(f_0(980)\pi^+\pi^-, f_0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{164}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                       |
|---|--------------------|-------------|--------------------------------------|
| <b>2.4±0.5±0.4</b>                        | LINK               | 07A         | FOCS 4-body fit, $\approx 5.7k$ evts |

$\Gamma(f_2(1270)\pi^+\pi^-, f_2 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+2\pi^-)$   $\Gamma_{165}/\Gamma_{153}$

This is the fit fraction from the coherent amplitude analysis.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                       |
|---|--------------------|-------------|--------------------------------------|
| <b>4.9±0.6±0.5</b>                        | LINK               | 07A         | FOCS 4-body fit, $\approx 5.7k$ evts |

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(K^-\pi^+)$   $\Gamma_{166}/\Gamma_{31}$

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                |
|---|-------------|--------------------|-------------|-------------------------------|
| <b>25.8±1.5±1.8</b>                       | 2724 ± 166  | RUBIN              | 06          | CLEO $e^+e^-$ at $\psi(3770)$ |

$\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{167}/\Gamma$

Unseen decay modes of the  $\eta$  are included.

| VALUE (units $10^{-4}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

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

|                       |              |        |    |                    |
|-----------------------|--------------|--------|----|--------------------|
| $6.4 \pm 1.0 \pm 0.4$ | $156 \pm 24$ | ARTUSO | 08 | CLEO See MENDEZ 10 |
|-----------------------|--------------|--------|----|--------------------|

$\Gamma(\eta\pi^0)/\Gamma(K^-\pi^+)$   $\Gamma_{167}/\Gamma_{31}$

Unseen decay modes of the  $\eta$  are included.

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

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

|                          |             |       |    |                    |
|--------------------------|-------------|-------|----|--------------------|
| $1.47 \pm 0.34 \pm 0.11$ | $62 \pm 14$ | RUBIN | 06 | CLEO See ARTUSO 08 |
|--------------------------|-------------|-------|----|--------------------|

$\Gamma(\eta\pi^0)/[\Gamma(K^-\pi^+) + \Gamma(K^+\pi^-)]$   $\Gamma_{167}/(\Gamma_{31} + \Gamma_{222})$

Unseen decay modes of the  $\eta$  are included.

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

**1.74 ± 0.19 OUR FIT**

|                           |              |        |    |                           |
|---------------------------|--------------|--------|----|---------------------------|
| <b>1.74 ± 0.15 ± 0.11</b> | $481 \pm 40$ | MENDEZ | 10 | CLEO $e^+e^-$ at 3774 MeV |
|---------------------------|--------------|--------|----|---------------------------|

$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{168}/\Gamma$

Unseen decay modes of the  $\omega$  are included.

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|-------|-----|-------------|------|---------|
|-------|-----|-------------|------|---------|

|                        |    |       |    |                               |
|------------------------|----|-------|----|-------------------------------|
| $< 2.6 \times 10^{-4}$ | 90 | RUBIN | 06 | CLEO $e^+e^-$ at $\psi(3770)$ |
|------------------------|----|-------|----|-------------------------------|

$\Gamma(2\pi^+2\pi^-\pi^0)/\Gamma(K^-\pi^+)$   $\Gamma_{169}/\Gamma_{31}$

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

|                         |                |       |    |                               |
|-------------------------|----------------|-------|----|-------------------------------|
| <b>10.7 ± 1.2 ± 0.5</b> | $1614 \pm 171$ | RUBIN | 06 | CLEO $e^+e^-$ at $\psi(3770)$ |
|-------------------------|----------------|-------|----|-------------------------------|

$\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{170}/\Gamma$

Unseen decay modes of the  $\eta$  are included.

| VALUE (units $10^{-4}$ ) | CL% | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|------|-------------|------|---------|
|--------------------------|-----|------|-------------|------|---------|

|                         |              |        |    |                               |
|-------------------------|--------------|--------|----|-------------------------------|
| <b>10.9 ± 1.3 ± 0.9</b> | $257 \pm 32$ | ARTUSO | 08 | CLEO $e^+e^-$ at $\psi(3770)$ |
|-------------------------|--------------|--------|----|-------------------------------|

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

|        |    |       |    |                               |
|--------|----|-------|----|-------------------------------|
| $< 19$ | 90 | RUBIN | 06 | CLEO $e^+e^-$ at $\psi(3770)$ |
|--------|----|-------|----|-------------------------------|

$\Gamma(\omega\pi^+\pi^-)/\Gamma(K^-\pi^+)$   $\Gamma_{171}/\Gamma_{31}$

Unseen decay modes of the  $\omega$  are included.

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

|                        |               |       |    |                               |
|------------------------|---------------|-------|----|-------------------------------|
| <b>4.1 ± 1.2 ± 0.4</b> | $472 \pm 132$ | RUBIN | 06 | CLEO $e^+e^-$ at $\psi(3770)$ |
|------------------------|---------------|-------|----|-------------------------------|

$\Gamma(3\pi^+3\pi^-)/\Gamma(K^-2\pi^+\pi^-)$   $\Gamma_{172}/\Gamma_{67}$

| VALUE (units $10^{-3}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

|                           |              |      |     |   |
|---------------------------|--------------|------|-----|---|
| <b>5.23 ± 0.59 ± 1.35</b> | $149 \pm 17$ | LINK | 04B | FOCS $\gamma A, \bar{E}_\gamma \approx 180$ GeV |
|---------------------------|--------------|------|-----|---|

$\Gamma(3\pi^+3\pi^-)/\Gamma(K^-3\pi^+2\pi^-)$   $\Gamma_{172}/\Gamma_{93}$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

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

|                          |                   |     |   |
|--------------------------|-------------------|-----|---|
| $1.93 \pm 0.47 \pm 0.48$ | <sup>1</sup> LINK | 04B | FOCS $\gamma A, \bar{E}_\gamma \approx 180$ GeV |
|--------------------------|-------------------|-----|---|

<sup>1</sup>This LINK 04B result is not independent of other results in these Listings.

$\Gamma(\eta'(958)\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{173}/\Gamma$

Unseen decay modes of the  $\eta'(958)$  are included.

| <u>VALUE (units <math>10^{-4}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|-------------|--------------------|-------------|----------------|
|---|-------------|--------------------|-------------|----------------|

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

|             |        |        |    |                    |
|-------------|--------|--------|----|--------------------|
| 8.1±1.5±0.6 | 50 ± 9 | ARTUSO | 08 | CLEO See MENDEZ 10 |
|-------------|--------|--------|----|--------------------|

$\Gamma(\eta'(958)\pi^0)/[\Gamma(K^-\pi^+) + \Gamma(K^+\pi^-)]$   $\Gamma_{173}/(\Gamma_{31}+\Gamma_{222})$

Unseen decay modes of the  $\eta'(958)$  are included.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|-------------|--------------------|-------------|----------------|
|---|-------------|--------------------|-------------|----------------|

**2.3±0.4 OUR FIT**

|                    |          |        |    |                           |
|--------------------|----------|--------|----|---------------------------|
| <b>2.3±0.3±0.2</b> | 159 ± 19 | MENDEZ | 10 | CLEO $e^+e^-$ at 3774 MeV |
|--------------------|----------|--------|----|---------------------------|

$\Gamma(\eta'(958)\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{174}/\Gamma$

Unseen decay modes of the  $\eta'(958)$  are included.

| <u>VALUE (units <math>10^{-4}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|-------------|--------------------|-------------|----------------|
|---|-------------|--------------------|-------------|----------------|

|                    |        |        |    |                               |
|--------------------|--------|--------|----|-------------------------------|
| <b>4.5±1.6±0.5</b> | 21 ± 8 | ARTUSO | 08 | CLEO $e^+e^-$ at $\psi(3770)$ |
|--------------------|--------|--------|----|-------------------------------|

$\Gamma(2\eta)/\Gamma_{\text{total}}$   $\Gamma_{175}/\Gamma$

Unseen decay modes of the  $\eta$  are included.

| <u>VALUE (units <math>10^{-4}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|-------------|--------------------|-------------|----------------|
|---|-------------|--------------------|-------------|----------------|

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

|              |          |        |    |                    |
|--------------|----------|--------|----|--------------------|
| 16.7±1.4±1.3 | 255 ± 22 | ARTUSO | 08 | CLEO See MENDEZ 10 |
|--------------|----------|--------|----|--------------------|

$\Gamma(2\eta)/[\Gamma(K^-\pi^+) + \Gamma(K^+\pi^-)]$   $\Gamma_{175}/(\Gamma_{31}+\Gamma_{222})$

Unseen decay modes of the  $\eta$  are included.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|-------------|--------------------|-------------|----------------|
|---|-------------|--------------------|-------------|----------------|

**4.3±0.5 OUR FIT**

|                    |          |        |    |                           |
|--------------------|----------|--------|----|---------------------------|
| <b>4.3±0.3±0.4</b> | 430 ± 29 | MENDEZ | 10 | CLEO $e^+e^-$ at 3774 MeV |
|--------------------|----------|--------|----|---------------------------|

$\Gamma(\eta\eta'(958))/\Gamma_{\text{total}}$   $\Gamma_{176}/\Gamma$

Unseen decay modes of the  $\eta$  and  $\eta'(958)$  are included.

| <u>VALUE (units <math>10^{-4}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|-------------|--------------------|-------------|----------------|
|---|-------------|--------------------|-------------|----------------|

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

|              |        |        |    |                    |
|--------------|--------|--------|----|--------------------|
| 12.6±2.5±1.1 | 46 ± 9 | ARTUSO | 08 | CLEO See MENDEZ 10 |
|--------------|--------|--------|----|--------------------|

$\Gamma(\eta\eta'(958))/[\Gamma(K^-\pi^+) + \Gamma(K^+\pi^-)]$   $\Gamma_{176}/(\Gamma_{31}+\Gamma_{222})$

Unseen decay modes of the  $\eta$  and  $\eta'(958)$  are included.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|-------------|--------------------|-------------|----------------|
|---|-------------|--------------------|-------------|----------------|

**2.7±0.7 OUR FIT**

|                    |         |        |    |                           |
|--------------------|---------|--------|----|---------------------------|
| <b>2.7±0.6±0.3</b> | 66 ± 15 | MENDEZ | 10 | CLEO $e^+e^-$ at 3774 MeV |
|--------------------|---------|--------|----|---------------------------|

————— **Hadronic modes with a  $K\bar{K}$  pair** —————

$\Gamma(K^+K^-)/\Gamma_{\text{total}}$   $\Gamma_{177}/\Gamma$

| <u>VALUE (units <math>10^{-3}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|-------------|--------------------|-------------|----------------|
|---|-------------|--------------------|-------------|----------------|

**4.01±0.07 OUR FIT** Error includes scale factor of 1.4.

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

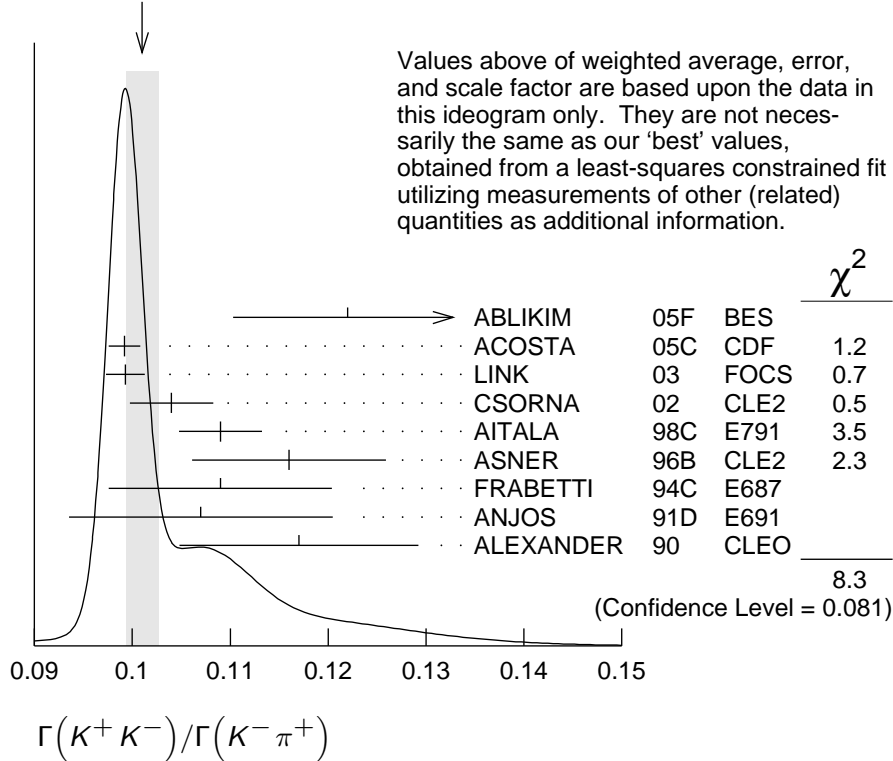
|                |           |           |    |                    |
|----------------|-----------|-----------|----|--------------------|
| 4.08±0.08±0.09 | 4746 ± 74 | BONVICINI | 08 | CLEO See MENDEZ 10 |
|----------------|-----------|-----------|----|--------------------|

$\Gamma(K^+ K^-)/\Gamma(K^- \pi^+)$

$\Gamma_{177}/\Gamma_{31}$

| VALUE   | EVTS  | DOCUMENT ID | TECN     | COMMENT  |
|---|---|-------------|----------|--|
| <b>0.1021±0.0015 OUR FIT</b>  | Error includes scale factor of 1.7.                         |             |          |  |
| <b>0.1010±0.0016 OUR AVERAGE</b>  | Error includes scale factor of 1.4. See the ideogram below. |             |          |  |
| 0.122 ±0.011 ±0.004   | 242 ± 20  | ABLIKIM     | 05F BES  | $e^+ e^- \approx \psi(3770)$                       |
| 0.0992±0.0011±0.0012  | 16k±200   | ACOSTA      | 05C CDF  | $p\bar{p}, \sqrt{s}=1.96$ TeV                      |
| 0.0993±0.0014±0.0014  | 11k   | LINK        | 03 FOCS  | $\gamma$ nucleus, $\bar{E}_\gamma \approx 180$ GeV |
| 0.1040±0.0033±0.0027  | 1900  | CSORNA      | 02 CLE2  | $e^+ e^- \approx \Upsilon(4S)$                     |
| 0.109 ±0.003 ±0.003   | 3317  | AITALA      | 98C E791 | $\pi^-$ nucleus, 500 GeV                           |
| 0.116 ±0.007 ±0.007   | 1102  | ASNER       | 96B CLE2 | $e^+ e^- \approx \Upsilon(4S)$                     |
| 0.109 ±0.007 ±0.009   | 581   | FRABETTI    | 94C E687 | $\gamma$ Be $\bar{E}_\gamma = 220$ GeV             |
| 0.107 ±0.010 ±0.009   | 193   | ANJOS       | 91D E691 | Photoproduction                                    |
| 0.117 ±0.010 ±0.007   | 249   | ALEXANDER   | 90 CLEO  | $e^+ e^-$ 10.5–11 GeV                              |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |   |             |          |  |
| 0.107 ±0.029 ±0.015   | 103   | ADAMOVICH   | 92 OMEG  | $\pi^-$ 340 GeV                                    |
| 0.138 ±0.027 ±0.010   | 155   | FRABETTI    | 92 E687  | $\gamma$ Be  |
| 0.16 ±0.05  | 34  | ALVAREZ     | 91B NA14 | Photoproduction                                    |
| 0.10 ±0.02 ±0.01  | 131   | ALBRECHT    | 90C ARG  | $e^+ e^- \approx 10$ GeV                           |
| 0.122 ±0.018 ±0.012   | 118   | BALTRUSAIT  | 85E MRK3 | $e^+ e^-$ 3.77 GeV                                 |
| 0.113 ±0.030  |   | ABRAMS      | 79D MRK2 | $e^+ e^-$ 3.77 GeV                                 |

WEIGHTED AVERAGE  
0.1010±0.0016 (Error scaled by 1.4)





$\Gamma(K^+ K^-)/[\Gamma(K^- \pi^+) + \Gamma(K^+ \pi^-)]$   $\Gamma_{177}/(\Gamma_{31} + \Gamma_{222})$

| VALUE (units $10^{-2}$ )   | EVTS                                | DOCUMENT ID | TECN | COMMENT                    |
|----------------------------|-------------------------------------|-------------|------|----------------------------|
| <b>0.18 ± 0.15 OUR FIT</b> | Error includes scale factor of 1.7. |             |      |                            |
| <b>0.41 ± 0.11 ± 0.12</b>  | 13.8k                               | MENDEZ      | 10   | CLEO $e^+ e^-$ at 3774 MeV |

$\Gamma(K^+ K^-)/\Gamma(\pi^+ \pi^-)$   $\Gamma_{177}/\Gamma_{132}$

The unused results here are redundant with  $\Gamma(K^+ K^-)/\Gamma(K^- \pi^+)$  and  $\Gamma(\pi^+ \pi^-)/\Gamma(K^- \pi^+)$  measurements by the same experiments.

| VALUE   | EVTS | DOCUMENT ID | TECN | COMMENT   |
|---|------|-------------|------|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • |      |             |      |   |
| 2.760 ± 0.040 ± 0.034   | 7334 | ACOSTA      | 05C  | CDF $p\bar{p}$ , $\sqrt{s}=1.96$ TeV                    |
| 2.81 ± 0.10 ± 0.06  |      | LINK        | 03   | FOCS $\gamma$ nucleus, $\bar{E}_\gamma \approx 180$ GeV |
| 2.96 ± 0.16 ± 0.15  | 710  | CSORNA      | 02   | CLE2 $e^+ e^- \approx \Upsilon(4S)$                     |
| 2.75 ± 0.15 ± 0.16  |      | AITALA      | 98C  | E791 $\pi^-$ nucleus, 500 GeV                           |
| 2.53 ± 0.46 ± 0.19  |      | FRABETTI    | 94C  | E687 $\gamma$ Be $\bar{E}_\gamma = 220$ GeV             |
| 2.23 ± 0.81 ± 0.46  |      | ADAMOVICH   | 92   | OMEG $\pi^-$ 340 GeV                                    |
| 1.95 ± 0.34 ± 0.22  |      | ANJOS       | 91D  | E691 Photoproduction                                    |
| 2.5 ± 0.7   |      | ALBRECHT    | 90C  | ARG $e^+ e^- \approx 10$ GeV                            |
| 2.35 ± 0.37 ± 0.28  |      | ALEXANDER   | 90   | CLEO $e^+ e^-$ 10.5–11 GeV                              |

$\Gamma(2K_S^0)/\Gamma_{total}$   $\Gamma_{178}/\Gamma$

| VALUE (units $10^{-4}$ )  | EVTS    | DOCUMENT ID | TECN | COMMENT            |
|---|---------|-------------|------|--------------------|
| • • • We do not use the following data for averages, fits, limits, etc. • • • |         |             |      |                    |
| 1.46 ± 0.32 ± 0.09  | 68 ± 15 | BONVICINI   | 08   | CLEO See MENDEZ 10 |

$\Gamma(2K_S^0)/[\Gamma(K^- \pi^+) + \Gamma(K^+ \pi^-)]$   $\Gamma_{178}/(\Gamma_{31} + \Gamma_{222})$

| VALUE (units $10^{-2}$ )   | EVTS                                | DOCUMENT ID | TECN | COMMENT                    |
|----------------------------|-------------------------------------|-------------|------|----------------------------|
| <b>0.45 ± 0.11 OUR FIT</b> | Error includes scale factor of 2.5. |             |      |                            |
| <b>0.41 ± 0.04 ± 0.02</b>  | 215 ± 23                            | MENDEZ      | 10   | CLEO $e^+ e^-$ at 3774 MeV |

$\Gamma(2K_S^0)/\Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{178}/\Gamma_{35}$

This is the same as  $\Gamma(K^0 \bar{K}^0) / \Gamma(\bar{K}^0 \pi^+ \pi^-)$  because  $D^0 \rightarrow K_S^0 K_L^0$  is forbidden by  $CP$  conservation.

| VALUE   | EVTS                                | DOCUMENT ID | TECN | COMMENT  |
|---|-------------------------------------|-------------|------|--|
| <b>0.0062 ± 0.0015 OUR FIT</b>  | Error includes scale factor of 2.2. |             |      |  |
| <b>0.0120 ± 0.0022 OUR AVERAGE</b>  |                                     |             |      |  |
| 0.0144 ± 0.0032 ± 0.0016  | 79 ± 17                             | LINK        | 05A  | FOCS $\gamma$ Be, $\bar{E}_\gamma \approx 180$ GeV |
| 0.0101 ± 0.0022 ± 0.0016  | 26                                  | ASNER       | 96B  | CLE2 $e^+ e^- \approx \Upsilon(4S)$                |
| 0.039 ± 0.013 ± 0.013   | 20 ± 7                              | FRABETTI    | 94J  | E687 $\gamma$ Be $\bar{E}_\gamma = 220$ GeV        |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                                     |             |      |  |
| 0.021 $^{+0.011}_{-0.008}$ ± 0.002  | 5                                   | ALEXANDER   | 90   | CLEO $e^+ e^-$ 10.5–11 GeV                         |

$\Gamma(K_S^0 K^- \pi^+)/\Gamma(K^- \pi^+)$   $\Gamma_{179}/\Gamma_{31}$

| VALUE                        | DOCUMENT ID                         | TECN | COMMENT                     |
|------------------------------|-------------------------------------|------|-----------------------------|
| <b>0.091 ± 0.014 OUR FIT</b> | Error includes scale factor of 1.2. |      |                             |
| <b>0.08 ± 0.03</b>           | <sup>1</sup> ANJOS                  | 91   | E691 $\gamma$ Be 80–240 GeV |

<sup>1</sup>The factor 100 at the top of column 2 of Table I of ANJOS 91 should be omitted.

$\Gamma(K_S^0 K^- \pi^+)/\Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{179}/\Gamma_{35}$

| VALUE                          | EVTS | DOCUMENT ID | TECN | COMMENT                             |
|--------------------------------|------|-------------|------|-------------------------------------|
| <b>0.125±0.017 OUR FIT</b>     |      |             |      | Error includes scale factor of 1.2. |
| <b>0.119±0.021 OUR AVERAGE</b> |      |             |      | Error includes scale factor of 1.3. |
| 0.108±0.019                    | 61   | AMMAR       | 91   | CLEO $e^+e^- \approx 10.5$ GeV      |
| 0.16 ±0.03 ±0.02               | 39   | ALBRECHT    | 90C  | ARG $e^+e^- \approx 10$ GeV         |

$\Gamma(\bar{K}^*(892)^0 K_S^0, \bar{K}^{*0} \rightarrow K^- \pi^+)/\Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{180}/\Gamma_{35}$

| VALUE   | CL% | DOCUMENT ID | TECN | COMMENT                        |
|---|-----|-------------|------|--------------------------------|
| <b>&lt;0.019</b>  | 90  | AMMAR       | 91   | CLEO $e^+e^- \approx 10.5$ GeV |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |             |      |                                |
| <0.02   | 90  | ALBRECHT    | 90C  | ARG $e^+e^- \approx 10$ GeV    |

$\Gamma(K_S^0 K^+ \pi^-)/\Gamma(K^- \pi^+)$   $\Gamma_{181}/\Gamma_{31}$

| VALUE  | DOCUMENT ID        | TECN | COMMENT                             |
|--|--------------------|------|-------------------------------------|
| <b>0.055±0.009 OUR FIT</b>   |                    |      | Error includes scale factor of 1.3. |
| <b>0.05 ±0.025</b>   | <sup>1</sup> ANJOS | 91   | E691 $\gamma$ Be 80–240 GeV         |
| <sup>1</sup> The factor 100 at the top of column 2 of Table I of ANJOS 91 should be omitted. |                    |      |                                     |

$\Gamma(K_S^0 K^+ \pi^-)/\Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{181}/\Gamma_{35}$

| VALUE                      | EVTS | DOCUMENT ID | TECN | COMMENT                             |
|----------------------------|------|-------------|------|-------------------------------------|
| <b>0.076±0.012 OUR FIT</b> |      |             |      | Error includes scale factor of 1.3. |
| <b>0.098±0.020</b>         | 55   | AMMAR       | 91   | CLEO $e^+e^- \approx 10.5$ GeV      |

$\Gamma(K_S^0 K^+ \pi^-)/\Gamma(K_S^0 K^- \pi^+)$   $\Gamma_{181}/\Gamma_{179}$

| VALUE                     | DOCUMENT ID | TECN | COMMENT   |
|---------------------------|-------------|------|---|
| <b>0.61 ±0.06 OUR FIT</b> |             |      | Error includes scale factor of 1.3.                 |
| <b>0.592±0.044±0.018</b>  | INSLER      | 12   | CLEO $e^+e^- \rightarrow D^0 \bar{D}^0$ at 3.77 GeV |

$\Gamma(K^*(892)^0 K_S^0, K^{*0} \rightarrow K^+ \pi^-)/\Gamma(\bar{K}^*(892)^0 K_S^0, \bar{K}^{*0} \rightarrow K^- \pi^+)$   $\Gamma_{182}/\Gamma_{180}$

| VALUE   | CL% | DOCUMENT ID         | TECN | COMMENT  |
|---|-----|---------------------|------|--|
| <b>0.356±0.034±0.007</b>  |     | <sup>1</sup> INSLER | 12   | CLEO $e^+e^- \rightarrow D^0 \bar{D}^0$ , 3.77 GeV |
| • • • We do not use the following data for averages, fits, limits, etc. • • •   |     |                     |      |  |
| <0.010  | 90  | AMMAR               | 91   | CLEO $e^+e^- \approx 10.5$ GeV                     |
| <sup>1</sup> Uses quantum correlations in $e^+e^- \rightarrow D^0 \bar{D}^0$ at the $\psi(3770)$ , where the signal side $D$ decays to $K_S^0 K \pi$ and the tag-side $D$ decays to $K \pi, K \pi \pi \pi, K \pi \pi^0$ . |     |                     |      |  |

$\Gamma(K^+ K^- \pi^0)/\Gamma(K^- \pi^+ \pi^0)$   $\Gamma_{183}/\Gamma_{50}$

| VALUE (units $10^{-2}$ )  | EVTS    | DOCUMENT ID | TECN     | COMMENT                       |
|---|---------|-------------|----------|-------------------------------|
| <b>2.37±0.03±0.04</b>   | 11k±122 | AUBERT,B    | 06X BABR | $e^+e^- \approx \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |         |             |          |                               |
| 0.95±0.26   | 151     | ASNER       | 96B CLE2 | $e^+e^- \approx \Upsilon(4S)$ |

$\Gamma(K^*(892)^+ K^-, K^*(892)^+ \rightarrow K^+ \pi^0)/\Gamma(K^+ K^- \pi^0)$   $\Gamma_{184}/\Gamma_{183}$

This is the "fit fraction" from the Dalitz-plot analysis with interference.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>          |
|---|--------------------|-------------|-------------------------|
| <b>44.4±0.8±0.6</b>                       | AUBERT             | 07T BABR    | Dalitz fit II, 11k evts |

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

|          |                        |          |                           |
|----------|------------------------|----------|---------------------------|
| 46.1±3.1 | <sup>1</sup> CAWLFIELD | 06A CLEO | Dalitz fit, 627 ± 30 evts |
|----------|------------------------|----------|---------------------------|

<sup>1</sup> The error on this CAWLFIELD 06A result is statistical only.

$\Gamma(K^*(892)^- K^+, K^*(892)^- \rightarrow K^- \pi^0)/\Gamma(K^+ K^- \pi^0)$   $\Gamma_{185}/\Gamma_{183}$

This is the "fit fraction" from the Dalitz-plot analysis with interference.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>          |
|---|--------------------|-------------|-------------------------|
| <b>15.9±0.7±0.6</b>                       | AUBERT             | 07T BABR    | Dalitz fit II, 11k evts |

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

|          |                        |          |                           |
|----------|------------------------|----------|---------------------------|
| 12.3±2.2 | <sup>1</sup> CAWLFIELD | 06A CLEO | Dalitz fit, 627 ± 30 evts |
|----------|------------------------|----------|---------------------------|

<sup>1</sup> The error on this CAWLFIELD 06A result is statistical only.

$\Gamma((K^+ \pi^0)_{S\text{-wave}} K^-)/\Gamma(K^+ K^- \pi^0)$   $\Gamma_{186}/\Gamma_{183}$

This is the "fit fraction" from the Dalitz-plot analysis with interference.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u>  | <u>TECN</u> | <u>COMMENT</u>          |
|---|---------------------|-------------|-------------------------|
| <b>71.1±3.7±1.9</b>                       | <sup>1</sup> AUBERT | 07T BABR    | Dalitz fit II, 11k evts |

<sup>1</sup> The only major difference between fits I and II in the AUBERT 07T analysis is in this mode, where the fit-I fraction is  $(16.3 \pm 3.4 \pm 2.1)\%$ .

$\Gamma((K^- \pi^0)_{S\text{-wave}} K^+)/\Gamma(K^+ K^- \pi^0)$   $\Gamma_{187}/\Gamma_{183}$

This is the "fit fraction" from the Dalitz-plot analysis with interference.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>          |
|---|--------------------|-------------|-------------------------|
| <b>3.9±0.9±1.0</b>                        | AUBERT             | 07T BABR    | Dalitz fit II, 11k evts |

$\Gamma(f_0(980)\pi^0, f_0 \rightarrow K^+ K^-)/\Gamma(K^+ K^- \pi^0)$   $\Gamma_{188}/\Gamma_{183}$

This is the "fit fraction" from the Dalitz-plot analysis with interference.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u>  | <u>TECN</u> | <u>COMMENT</u>          |
|---|---------------------|-------------|-------------------------|
| <b>10.5±1.1±1.2</b>                       | <sup>1</sup> AUBERT | 07T BABR    | Dalitz fit II, 11k evts |

<sup>1</sup> When AUBERT 07T replace the  $f_0(980)\pi^0$  mode with  $a_0(980)\pi^0$ , the fit fraction is a negligibly different  $(11.0 \pm 1.5 \pm 1.2)\%$ .

$\Gamma(\phi\pi^0, \phi \rightarrow K^+ K^-)/\Gamma(K^+ K^- \pi^0)$   $\Gamma_{189}/\Gamma_{183}$

This is the "fit fraction" from the Dalitz-plot analysis with interference.

| <u>VALUE (units <math>10^{-2}</math>)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>          |
|---|--------------------|-------------|-------------------------|
| <b>19.4±0.6±0.5</b>                       | AUBERT             | 07T BABR    | Dalitz fit II, 11k evts |

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

|          |                        |          |                           |
|----------|------------------------|----------|---------------------------|
| 14.9±1.6 | <sup>1</sup> CAWLFIELD | 06A CLEO | Dalitz fit, 627 ± 30 evts |
|----------|------------------------|----------|---------------------------|

<sup>1</sup> The error on this CAWLFIELD 06A result is statistical only.

$\Gamma(K^+ K^- \pi^0 \text{ nonresonant}) / \Gamma(K^+ K^- \pi^0)$   $\Gamma_{190} / \Gamma_{183}$

This is the "fit fraction" from the Dalitz-plot analysis with interference.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

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

$0.360 \pm 0.037$  <sup>1</sup> CAWLFIELD 06A CLEO Dalitz fit,  $627 \pm 30$  evts

<sup>1</sup> The error is statistical only. CAWLFIELD 06A also fits the Dalitz plot replacing this flat nonresonant background with broad  $S$ -wave  $\kappa^\pm \rightarrow K^\pm \pi^0$  resonances. There is no significant improvement in the fit, and  $K^{*\pm} K^\mp$  and  $\phi \pi^0$  results are not much changed.

$\Gamma(2K_S^0 \pi^0) / \Gamma_{\text{total}}$   $\Gamma_{191} / \Gamma$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

**<0.00059** ASNER 96B CLE2  $e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\phi \pi^0) / \Gamma(K^+ K^-)$   $\Gamma_{213} / \Gamma_{177}$

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-------|------|-------------|------|---------|
|-------|------|-------------|------|---------|

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

$0.194 \pm 0.006 \pm 0.009$  1254 TAJIMA 04 BELL  $e^+ e^-$  at  $\Upsilon(4S)$

$\Gamma(\phi \eta) / \Gamma(K^+ K^-)$   $\Gamma_{214} / \Gamma_{177}$

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

**$3.59 \pm 1.14 \pm 0.18$**  31 TAJIMA 04 BELL  $e^+ e^-$  at  $\Upsilon(4S)$

$\Gamma(\phi \omega) / \Gamma_{\text{total}}$   $\Gamma_{215} / \Gamma$

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|-------|-----|-------------|------|---------|
|-------|-----|-------------|------|---------|

**<0.0021** 90 ALBRECHT 94i ARG  $e^+ e^- \approx 10$  GeV

$\Gamma(K^+ K^- \pi^+ \pi^-) / \Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{192} / \Gamma_{67}$

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|------|-------------|------|---------|
|--------------------------|------|-------------|------|---------|

**$3.00 \pm 0.13$  OUR AVERAGE**

$2.95 \pm 0.11 \pm 0.08$  2669  $\pm$  101 <sup>1</sup> LINK 05G FOCS  $\gamma$ Be,  $\bar{E}_\gamma \approx 180$  GeV

$3.13 \pm 0.37 \pm 0.36$  136  $\pm$  15 AITALA 98D E791  $\pi^-$  nucleus, 500 GeV

$3.5 \pm 0.4 \pm 0.2$  244  $\pm$  26 FRABETTI 95C E687  $\gamma$ Be,  $\bar{E}_\gamma \approx 200$  GeV

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

$4.4 \pm 1.8 \pm 0.5$  19  $\pm$  8 ABLIKIM 05F BES  $e^+ e^- \approx \psi(3770)$

$4.1 \pm 0.7 \pm 0.5$  114  $\pm$  20 ALBRECHT 94i ARG  $e^+ e^- \approx 10$  GeV

$3.14 \pm 1.0$  89  $\pm$  29 AMMAR 91 CLEO  $e^+ e^- \approx 10.5$  GeV

$2.8^{+0.8}_{-0.7}$  ANJOS 91 E691  $\gamma$ Be 80–240 GeV

<sup>1</sup> LINK 05G uses a smaller, cleaner subset of  $1279 \pm 48$  events for the amplitude analysis that gives the results in the next data blocks.

$\Gamma(\phi(\pi^+ \pi^-)_{S\text{-wave}, \phi \rightarrow K^+ K^-}) / \Gamma(K^+ K^- \pi^+ \pi^-)$   $\Gamma_{193} / \Gamma_{192}$

This is the fraction from a coherent amplitude analysis.

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

**$10.3 \pm 1.0 \pm 0.8$**  ARTUSO 12 CLEO Fitting 2959 evts.

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

1  $\pm$  1 LINK 05G FOCS Fits  $1279 \pm 48$  evts.

$$\Gamma((\phi\rho^0)_{S\text{-wave}}, \phi \rightarrow K^+ K^-) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{194} / \Gamma_{192}$$

This is the fraction from a coherent amplitude analysis.

| VALUE (%)   | DOCUMENT ID | TECN | COMMENT                   |
|---|-------------|------|---------------------------|
| <b>38.3±2.5±3.8</b>   | ARTUSO      | 12   | CLEO Fitting 2959 evts.   |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |      |                           |
| 29 ±2 ±1  | LINK        | 05G  | FOCS Fits 1279 ± 48 evts. |

$$\Gamma((\phi\rho^0)_{D\text{-wave}}, \phi \rightarrow K^+ K^-) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{195} / \Gamma_{192}$$

| VALUE (%)          | DOCUMENT ID | TECN | COMMENT                 |
|--------------------|-------------|------|-------------------------|
| <b>3.4±0.7±0.6</b> | ARTUSO      | 12   | CLEO Fitting 2959 evts. |

$$\Gamma((K^{*0}\bar{K}^{*0})_{S\text{-wave}}, K^{*0} \rightarrow K^\pm \pi^\mp) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{196} / \Gamma_{192}$$

| VALUE (%)          | DOCUMENT ID | TECN | COMMENT                 |
|--------------------|-------------|------|-------------------------|
| <b>6.1±0.8±0.9</b> | ARTUSO      | 12   | CLEO Fitting 2959 evts. |

$$\Gamma((K^- \pi^+)_{P\text{-wave}}, (K^+ \pi^-)_{S\text{-wave}}) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{197} / \Gamma_{192}$$

| VALUE (%)           | DOCUMENT ID | TECN | COMMENT                 |
|---------------------|-------------|------|-------------------------|
| <b>10.9±1.2±1.7</b> | ARTUSO      | 12   | CLEO Fitting 2959 evts. |

$$\Gamma(K_1(1270)^+ K^-, K_1(1270)^+ \rightarrow K^{*0} \pi^+) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{198} / \Gamma_{192}$$

| VALUE (%)          | DOCUMENT ID | TECN | COMMENT                 |
|--------------------|-------------|------|-------------------------|
| <b>7.3±0.8±1.9</b> | ARTUSO      | 12   | CLEO Fitting 2959 evts. |

$$\Gamma(K_1(1270)^+ K^-, K_1(1270)^+ \rightarrow \rho^0 K^+) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{199} / \Gamma_{192}$$

| VALUE (%)          | DOCUMENT ID | TECN | COMMENT                 |
|--------------------|-------------|------|-------------------------|
| <b>4.7±0.7±0.8</b> | ARTUSO      | 12   | CLEO Fitting 2959 evts. |

$$\Gamma(K_1(1270)^- K^+, K_1(1270)^- \rightarrow \bar{K}^{*0} \pi^-) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{200} / \Gamma_{192}$$

| VALUE (%)          | DOCUMENT ID | TECN | COMMENT                 |
|--------------------|-------------|------|-------------------------|
| <b>0.9±0.3±0.4</b> | ARTUSO      | 12   | CLEO Fitting 2959 evts. |

$$\Gamma(K_1(1270)^- K^+, K_1(1270)^- \rightarrow \rho^0 K^-) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{201} / \Gamma_{192}$$

| VALUE (%)          | DOCUMENT ID | TECN | COMMENT                 |
|--------------------|-------------|------|-------------------------|
| <b>6.0±0.8±0.6</b> | ARTUSO      | 12   | CLEO Fitting 2959 evts. |

$$\Gamma(K^*(1410)^+ K^-, K^*(1410)^+ \rightarrow K^{*0} \pi^+) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{202} / \Gamma_{192}$$

| VALUE (%)          | DOCUMENT ID | TECN | COMMENT                 |
|--------------------|-------------|------|-------------------------|
| <b>4.2±0.7±0.8</b> | ARTUSO      | 12   | CLEO Fitting 2959 evts. |

$$\Gamma(K^*(1410)^- K^+, K^*(1410)^- \rightarrow \bar{K}^{*0} \pi^-) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{203} / \Gamma_{192}$$

| VALUE (%)          | DOCUMENT ID | TECN | COMMENT                 |
|--------------------|-------------|------|-------------------------|
| <b>4.7±0.7±0.7</b> | ARTUSO      | 12   | CLEO Fitting 2959 evts. |

$$\Gamma(K^+ K^- \rho^0 \text{3-body}) / \Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{204} / \Gamma_{192}$$

This is the fraction from a coherent amplitude analysis.

| VALUE (%) | DOCUMENT ID | TECN | COMMENT                   |
|-----------|-------------|------|---------------------------|
| 2±2±2     | LINK        | 05G  | FOCS Fits 1279 ± 48 evts. |

$\Gamma(f_0(980)\pi^+\pi^-, f_0 \rightarrow K^+K^-)/\Gamma(K^+K^-\pi^+\pi^-)$   $\Gamma_{205}/\Gamma_{192}$

This is the fraction from a coherent amplitude analysis.

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

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

|            |      |          |                      |
|------------|------|----------|----------------------|
| 15 ± 3 ± 2 | LINK | 05G FOCS | Fits 1279 ± 48 evts. |
|------------|------|----------|----------------------|

$\Gamma(K^*(892)^0 K^\mp \pi^\pm \text{3-body}, K^{*0} \rightarrow K^\pm \pi^\mp)/\Gamma(K^+K^-\pi^+\pi^-)$   $\Gamma_{206}/\Gamma_{192}$

This is the fraction from a coherent amplitude analysis.

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

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

|            |      |          |                      |
|------------|------|----------|----------------------|
| 11 ± 2 ± 1 | LINK | 05G FOCS | Fits 1279 ± 48 evts. |
|------------|------|----------|----------------------|

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0, K^{*0} \rightarrow K^\pm \pi^\mp)/\Gamma(K^+K^-\pi^+\pi^-)$   $\Gamma_{207}/\Gamma_{192}$

This is the fraction from a coherent amplitude analysis.

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

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

|           |      |          |                      |
|-----------|------|----------|----------------------|
| 3 ± 2 ± 1 | LINK | 05G FOCS | Fits 1279 ± 48 evts. |
|-----------|------|----------|----------------------|

$\Gamma(K_1(1270)^\pm K^\mp, K_1(1270)^\pm \rightarrow K^\pm \pi^+ \pi^-)/\Gamma(K^+K^-\pi^+\pi^-)$   $\Gamma_{208}/\Gamma_{192}$

This is the fraction from a coherent amplitude analysis.

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

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

|            |                   |          |                      |
|------------|-------------------|----------|----------------------|
| 33 ± 6 ± 4 | <sup>1</sup> LINK | 05G FOCS | Fits 1279 ± 48 evts. |
|------------|-------------------|----------|----------------------|

<sup>1</sup>This LINK 05G value includes  $K_1(1270)^\pm \rightarrow \rho^0 K^\pm, \rightarrow K_0^*(1430)^0 \pi^\pm$ , and  $K^*(892)^0 \pi^\pm$ .

$\Gamma(K_1(1400)^\pm K^\mp, K_1(1400)^\pm \rightarrow K^\pm \pi^+ \pi^-)/\Gamma(K^+K^-\pi^+\pi^-)$   $\Gamma_{209}/\Gamma_{192}$

This is the fraction from a coherent amplitude analysis.

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

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

|            |      |          |                      |
|------------|------|----------|----------------------|
| 22 ± 3 ± 4 | LINK | 05G FOCS | Fits 1279 ± 48 evts. |
|------------|------|----------|----------------------|

$\Gamma(2K_S^0 \pi^+ \pi^-)/\Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{210}/\Gamma_{35}$

| VALUE (units 10 <sup>-2</sup> ) | EVTS | DOCUMENT ID | TECN | COMMENT |
|---------------------------------|------|-------------|------|---------|
|---------------------------------|------|-------------|------|---------|

**4.3 ± 0.8 OUR AVERAGE**

|                    |          |      |          |   |
|--------------------|----------|------|----------|---|
| 4.16 ± 0.70 ± 0.42 | 113 ± 21 | LINK | 05A FOCS | $\gamma$ Be, $\bar{E}_\gamma \approx 180$ GeV |
|--------------------|----------|------|----------|---|

|                 |    |          |         |                          |
|-----------------|----|----------|---------|--------------------------|
| 6.2 ± 2.0 ± 1.6 | 25 | ALBRECHT | 94I ARG | $e^+ e^- \approx 10$ GeV |
|-----------------|----|----------|---------|--------------------------|

$\Gamma(K_S^0 K^- 2\pi^+ \pi^-)/\Gamma(K_S^0 2\pi^+ 2\pi^-)$   $\Gamma_{211}/\Gamma_{87}$

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|-------|-----|-------------|------|---------|
|-------|-----|-------------|------|---------|

|        |    |      |          |  |
|--------|----|------|----------|--|
| <0.054 | 90 | LINK | 04D FOCS | $\gamma$ A, $\bar{E}_\gamma \approx 180$ GeV |
|--------|----|------|----------|--|

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$   $\Gamma_{212}/\Gamma$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-------------|------|---------|
|-------|-------------|------|---------|

|                        |                     |          |                    |
|------------------------|---------------------|----------|--------------------|
| <b>0.0031 ± 0.0020</b> | <sup>1</sup> BARLAG | 92C ACCM | $\pi^-$ Cu 230 GeV |
|------------------------|---------------------|----------|--------------------|

<sup>1</sup>BARLAG 92C computes the branching fraction using topological normalization.

————— Radiative modes —————

| $\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$ |            |                    |             |      | $\Gamma_{216}/\Gamma$ |
|--|------------|--------------------|-------------|------|-----------------------|
| <u>VALUE</u>                                 | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> |      |                       |
| $<2.4 \times 10^{-4}$                        | 90         | ASNER              | 98          | CLE2 |                       |

| $\Gamma(\omega\gamma)/\Gamma_{\text{total}}$ |            |                    |             |      | $\Gamma_{217}/\Gamma$ |
|--|------------|--------------------|-------------|------|-----------------------|
| <u>VALUE</u>                                 | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> |      |                       |
| $<2.4 \times 10^{-4}$                        | 90         | ASNER              | 98          | CLE2 |                       |

| $\Gamma(\phi\gamma)/\Gamma(K^+K^-)$                   |             |                    |             |                | $\Gamma_{218}/\Gamma_{177}$ |
|---|-------------|--------------------|-------------|----------------|-----------------------------|
| <u>VALUE (units <math>10^{-3}</math>)</u>             | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                             |
| <b>6.8 ± 0.9 OUR FIT</b>                              |             |                    |             |                |                             |
| <b>6.31<sup>+1.70+0.30</sup><sub>-1.48-0.36</sub></b> | 28          | TAJIMA             | 04          | BELL           | $e^+e^-$ at $\Upsilon(4S)$  |

| $\Gamma(\phi\gamma)/\Gamma(K^-\pi^+)$     |             |                    |             |                | $\Gamma_{218}/\Gamma_{31}$ |
|---|-------------|--------------------|-------------|----------------|----------------------------|
| <u>VALUE (units <math>10^{-4}</math>)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                            |
| <b>7.0 ± 0.9 OUR FIT</b>                  |             |                    |             |                |                            |
| <b>7.15 ± 0.78 ± 0.69</b>                 | 243 ± 25    | AUBERT             | 08AZ        | BABR           | $e^+e^- \approx 10.6$ GeV  |

| $\Gamma(\bar{K}^*(892)^0\gamma)/\Gamma(K^-\pi^+)$ |             |                    |             |                | $\Gamma_{219}/\Gamma_{31}$ |
|---|-------------|--------------------|-------------|----------------|----------------------------|
| <u>VALUE (units <math>10^{-3}</math>)</u>         | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                            |
| <b>8.43 ± 0.51 ± 0.70</b>                         | 2286 ± 113  | AUBERT             | 08AZ        | BABR           | $e^+e^- \approx 10.6$ GeV  |

————— Doubly Cabibbo-suppressed / Mixing modes —————

| $\Gamma(K^+\ell^-\bar{\nu}_\ell \text{ via } \bar{D}^0)/\Gamma(K^-\ell^+\nu_\ell)$  |  |  |  |  | $\Gamma_{220}/\Gamma_{17}$ |
|---|--|--|--|--|----------------------------|
| <p>This is a limit on <math>R_M</math> without the complications of possible doubly Cabibbo-suppressed decays that occur when using hadronic modes. For the limits on <math> m_1 - m_2 </math> and <math>(\Gamma_1 - \Gamma_2)/\Gamma</math> that come from the best mixing limit, see near the beginning of these <math>D^0</math> Listings.</p> |  |  |  |  |                            |

| <u>VALUE</u>           | <u>CL%</u> | <u>DOCUMENT ID</u>  | <u>TECN</u> | <u>COMMENT</u> |                      |
|------------------------|------------|---------------------|-------------|----------------|----------------------|
| $< 6.1 \times 10^{-4}$ | 90         | <sup>1</sup> BITENC | 08          | BELL           | $e^+e^-$ , 10.58 GeV |

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

|                       |    |                     |     |      |                          |
|-----------------------|----|---------------------|-----|------|--------------------------|
| $< 50 \times 10^{-4}$ | 90 | <sup>2</sup> AITALA | 96C | E791 | $\pi^-$ nucleus, 500 GeV |
|-----------------------|----|---------------------|-----|------|--------------------------|

<sup>1</sup> The BITENC 08 right-sign sample includes about 15% of  $D^0 \rightarrow K^-\pi^0\ell^+\nu_\ell$  and other decays.

<sup>2</sup> AITALA 96C uses  $D^{*+} \rightarrow D^0\pi^+$  (and charge conjugate) decays to identify the charm at production and  $D^0 \rightarrow K^-\ell^+\nu_\ell$  (and charge conjugate) decays to identify the charm at decay.

| $\Gamma(K^+ \text{ or } K^*(892)^+ e^-\bar{\nu}_e \text{ via } \bar{D}^0)/[\Gamma(K^-\ell^+\nu_\ell) + \Gamma(K^*(892)^-\ell^+\nu_\ell)]$ |  |  |  |  | $\Gamma_{221}/(\Gamma_{18}+\Gamma_{20})$ |
|---|--|--|--|--|--|
|---|--|--|--|--|--|

This is a limit on  $R_M$  without the complications of possible doubly Cabibbo-suppressed decays that occur when using hadronic modes. The experiments use  $D^{*+} \rightarrow D^0\pi^+$  (and charge conjugate) decays to identify the charm at production and the charge of the  $e$  to identify the charm at decay. These limits do not allow  $CP$  violation. For the

limits on  $|m_1 - m_2|$  and  $(\Gamma_1 - \Gamma_2)/\Gamma$  that come from the best mixing limit, see near the beginning of these  $D^0$  Listings.

| <u>VALUE</u>  | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                  |
|---|------------|--------------------|-------------|---------------------------------|
| <b>&lt;0.001</b>  | 90         | BITENC             | 05          | BELL $e^+e^- \approx 10.6$ GeV  |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |            |                    |             |                                 |
| $-0.0013 < R < +0.0012$   | 90         | AUBERT             | 07AB        | BABR $e^+e^- \approx 10.58$ GeV |
| <0.0078   | 90         | CAWLFIELD          | 05          | CLEO $e^+e^- \approx 10.6$ GeV  |
| <0.0042   | 90         | AUBERT,B           | 04Q         | BABR See AUBERT 07AB            |

### $\Gamma(K^+\pi^-)/\Gamma(K^-\pi^+)$ $\Gamma_{222}/\Gamma_{31}$

This is  $R$ , the time-integrated wrong-sign rate compared to the right-sign rate. See the note on “ $D^0$ - $\bar{D}^0$  Mixing,” near the start of the  $D^0$  Listings.

The experiments here use the charge of the pion in  $D^*(2010)^\pm \rightarrow (D^0 \text{ or } \bar{D}^0) \pi^\pm$  decay to tell whether a  $D^0$  or a  $\bar{D}^0$  was born. The  $D^0 \rightarrow K^+\pi^-$  decay can occur directly by doubly Cabibbo-suppressed (DCS) decay, or indirectly by  $D^0 \rightarrow \bar{D}^0$  mixing followed by  $\bar{D}^0 \rightarrow K^+\pi^-$  decay. Some of the experiments can use the decay-time information to disentangle the two mechanisms. Here, we list the experimental branching ratio, which if there is no mixing is the DCS ratio. See the next data block for values of the DCS ratio  $R_D$ , and the following data block for limits on the mixing ratio  $R_M$ . See the section on  $CP$ -violating asymmetries near the end of this  $D^0$  Listing for values of  $A_D$ , and the note on “ $D^0$ - $\bar{D}^0$  Mixing” for limits on  $x'$  and  $y'$ .

Some early limits have been omitted from this Listing; see our 1998 edition (The European Physical Journal **C3** 1 (1998)) and our 2006 edition (Journal of Physics **G33** 1 (2006)).

| <u>VALUE (units <math>10^{-3}</math>)</u>                                     | <u>EVTS</u>   | <u>DOCUMENT ID</u>     | <u>TECN</u> | <u>COMMENT</u>                         |
|---|---|------------------------|-------------|--|
| <b><math>3.79 \pm 0.18</math> OUR FIT</b>                                     | Error includes scale factor of 3.3.                         |                        |             |  |
| <b><math>3.79 \pm 0.18</math> OUR AVERAGE</b>                                 | Error includes scale factor of 3.3. See the ideogram below. |                        |             |  |
| $4.15 \pm 0.10$   | $12.7 \pm 0.3k$   | <sup>1</sup> AALTONEN  | 08E         | CDF $p\bar{p}$ , $\sqrt{s} = 1.96$ TeV |
| $3.53 \pm 0.08 \pm 0.04$  | $4030 \pm 90$   | <sup>2</sup> AUBERT    | 07W         | BABR $e^+e^- \approx 10.6$ GeV         |
| $3.77 \pm 0.08 \pm 0.05$  | $4024 \pm 88$   | <sup>1</sup> ZHANG     | 06          | BELL $e^+e^-$                          |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |   |                        |             |  |
| $4.05 \pm 0.21 \pm 0.11$  | $2.0 \pm 0.1k$  | <sup>3</sup> ABULENCIA | 06X         | CDF See AALTONEN 08E                   |
| $3.81 \pm 0.17^{+0.08}_{-0.16}$   | $845 \pm 40$  | <sup>2</sup> LI        | 05A         | BELL See ZHANG 06                      |
| $4.29^{+0.63}_{-0.61} \pm 0.27$   | 234   | <sup>4</sup> LINK      | 05H         | FOCS $\gamma$ nucleus                  |
| $3.57 \pm 0.22 \pm 0.27$  |   | <sup>5</sup> AUBERT    | 03Z         | BABR See AUBERT 07W                    |
| $4.04 \pm 0.85 \pm 0.25$  | 149   | <sup>6</sup> LINK      | 01          | FOCS $\gamma$ nucleus                  |
| $3.32^{+0.63}_{-0.65} \pm 0.40$   | 45  | <sup>1</sup> GODANG    | 00          | CLE2 $e^+e^-$                          |
| $6.8^{+3.4}_{-3.3} \pm 0.7$   | 34  | <sup>2</sup> AITALA    | 98          | E791 $\pi^-$ nucl., 500 GeV            |

<sup>1</sup> GODANG 00, ZHANG 06, and AALTONEN 08E allow  $CP$  violation.

<sup>2</sup> AITALA 98, LI 05A, and AUBERT 07W assume no  $CP$  violation.

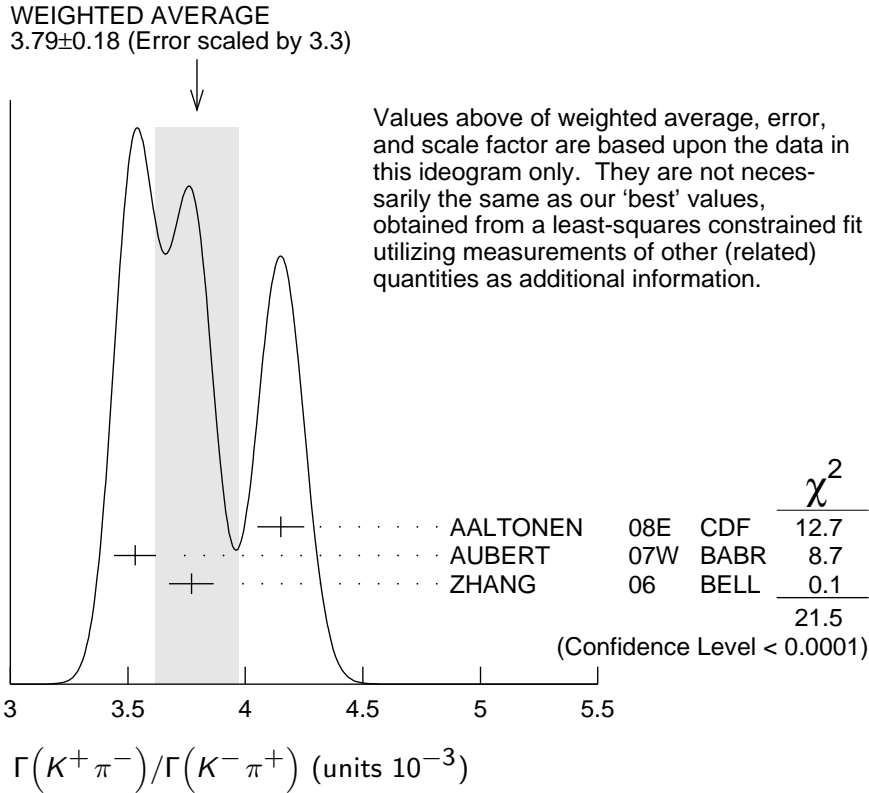
<sup>3</sup> This ABULENCIA 06X result assumes no mixing.

<sup>4</sup> This LINK 05H result assumes no mixing but allows  $CP$  violation. If neither mixing nor  $CP$  violation is allowed,  $R = (4.29 \pm 0.63 \pm 0.28) \times 10^{-3}$ .

<sup>5</sup> This AUBERT 03Z result allows  $CP$  violation. If  $CP$  violation is not allowed,  $R = 0.00359 \pm 0.00020 \pm 0.00027$ .



<sup>6</sup>This LINK 01 result assumes no mixing or *CP* violation.



### $\Gamma(K^+ \pi^- \text{ via DCS}) / \Gamma(K^- \pi^+)$

### $\Gamma_{223} / \Gamma_{31}$

This is  $R_D$ , the doubly Cabibbo-suppressed ratio when mixing is allowed.

| VALUE (units $10^{-3}$ )  | CL% | EVTS  | DOCUMENT ID         | TECN     | COMMENT                            |
|---|-----|---|---------------------|----------|------------------------------------|
| <b>3.37 ± 0.21 OUR AVERAGE</b>  |     | Error includes scale factor of 1.8. See the ideogram below. |                     |          |                                    |
| 3.04 ± 0.55   |     | 12.7 ± 0.3k   | AALTONEN            | 08E CDF  | $p\bar{p}$ , $\sqrt{s} = 1.96$ TeV |
| 3.03 ± 0.16 ± 0.10  |     | 4030 ± 90   | <sup>1</sup> AUBERT | 07W BABR | $e^+ e^- \approx 10.6$ GeV         |
| 3.64 ± 0.17   |     | 4024 ± 88   | <sup>2</sup> ZHANG  | 06 BELL  | $e^+ e^-$                          |
| 5.17 <sup>+</sup> <sub>-</sub> 1.47 ± 0.76                                    |     | 234   | <sup>3</sup> LINK   | 05H FOCS | $\gamma$ nucleus                   |
| 4.8 ± 1.2 ± 0.4   |     | 45  | <sup>4</sup> GODANG | 00 CLE2  | $e^+ e^-$                          |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |     |   |                     |          |                                    |
| 2.87 ± 0.37   |     | 845 ± 40  | LI                  | 05A BELL | See ZHANG 06                       |
| 2.3 < $R_D$ < 5.2   | 95  |   | <sup>5</sup> AUBERT | 03Z BABR | See AUBERT 07W                     |
| 9.0 <sup>+</sup> <sub>-</sub> 12.0 ± 4.4                                      |     | 34  | <sup>6</sup> AITALA | 98 E791  | $\pi^-$ nucl., 500 GeV             |

<sup>1</sup>This AUBERT 07W result is the same whether or not *CP* violation is allowed.

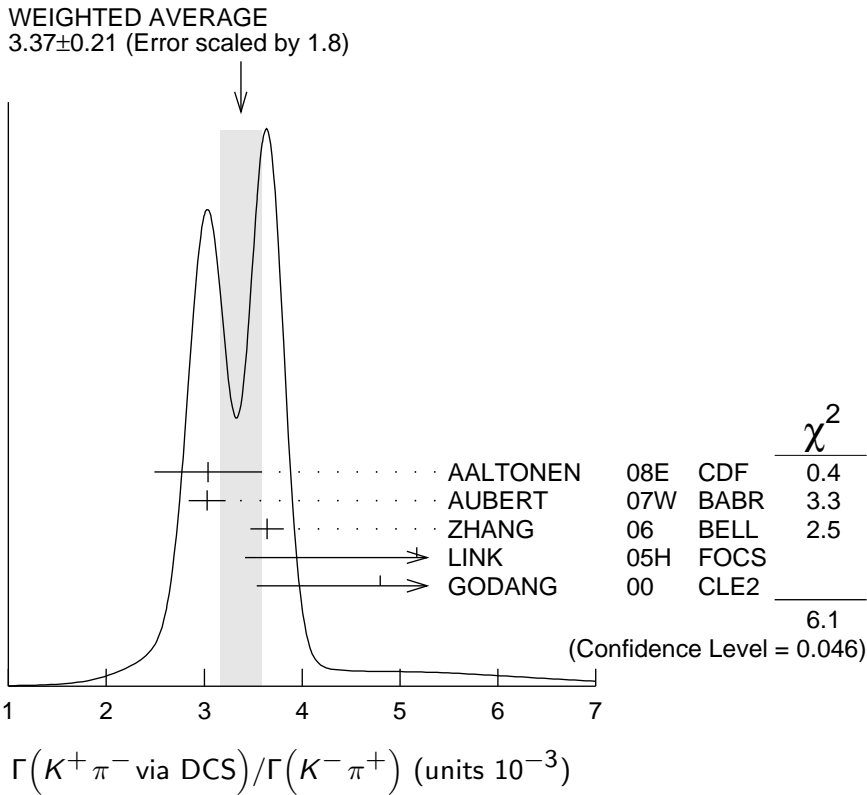
<sup>2</sup>This ZHANG 06 assumes no *CP* violation.

<sup>3</sup>This LINK 05H result allows *CP* violation. Allowing mixing but not *CP* violation,  $R_D = (3.81^{+1.67}_{-1.63} \pm 0.92) \times 10^{-3}$ .

<sup>4</sup>This GODANG 00 result allows *CP* violation.

<sup>5</sup>This AUBERT 03Z result allows *CP* violation. If only mixing is allowed, the 95% confidence level interval is  $(2.4 < R_D < 4.9) \times 10^{-3}$ .

<sup>6</sup>This AITALA 98 result assumes no *CP* violation.



$\Gamma(K^+ \pi^- \text{ via } \bar{D}^0) / \Gamma(K^- \pi^+)$

$\Gamma_{224} / \Gamma_{31}$

This is  $R_M$  in the note on “ $D^0$ - $\bar{D}^0$  Mixing” near the start of the  $D^0$  Listings. The experiments here (1) use the charge of the pion in  $D^*(2010)^\pm \rightarrow (D^0 \text{ or } \bar{D}^0) \pi^\pm$  decay to tell whether a  $D^0$  or a  $\bar{D}^0$  was born; and (2) use the decay-time distribution to disentangle doubly Cabibbo-suppressed decay and mixing. For the limits on  $|m_1 - m_2|$  and  $(\Gamma_1 - \Gamma_2) / \Gamma$  that come from the best mixing limit, see near the beginning of these  $D^0$  Listings.

| VALUE   | CL% | DOCUMENT ID         | TECN     | COMMENT              |
|---|-----|---------------------|----------|----------------------|
| <b>&lt;0.00040</b>  | 95  | <sup>1</sup> ZHANG  | 06 BELL  | $e^+ e^-$            |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |                     |          |                      |
| <0.00046  | 95  | <sup>2</sup> LI     | 05A BELL | See ZHANG 06         |
| <0.0063   | 95  | <sup>3</sup> LINK   | 05H FOCS | $\gamma$ nucleus     |
| <0.0013   | 95  | <sup>4</sup> AUBERT | 03Z BABR | $e^+ e^-$ , 10.6 GeV |
| <0.00041  | 95  | <sup>5</sup> GODANG | 00 CLE2  | $e^+ e^-$            |
| <0.0092   | 95  | <sup>6</sup> BARATE | 98W ALEP | $e^+ e^-$ at $Z^0$   |
| <0.005  | 90  | <sup>7</sup> ANJOS  | 88C E691 | Photoproduction      |

<sup>1</sup> This ZHANG 06 result allows  $CP$  violation, but the result does not change if  $CP$  violation is not allowed.  
<sup>2</sup> This LI 05A result allows  $CP$  violation. The limit becomes  $< 0.00042$  (95% CL) if  $CP$  violation is not allowed.  
<sup>3</sup> LINK 05H obtains the same result whether or not  $CP$  violation is allowed.  
<sup>4</sup> This AUBERT 03Z result allows  $CP$  violation and assumes that the strong phase between  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$  is small, and limits only  $D^0 \rightarrow \bar{D}^0$  transitions via off-shell intermediate states. The limit on transitions via on-shell intermediate states is 0.0016.

<sup>5</sup> This GODANG 00 result allows  $CP$  violation and assumes that the strong phase between  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$  is small, and limits only  $D^0 \rightarrow \bar{D}^0$  transitions via off-shell intermediate states. The limit on transitions via on-shell intermediate states is 0.0017.

<sup>6</sup> This BARATE 98W result assumes no interference between the DCS and mixing amplitudes ( $y' = 0$  in the note on " $D^0$ - $\bar{D}^0$  Mixing" near the start of the  $D^0$  Listings). When interference is allowed, the limit degrades to 0.036 (95%CL).

<sup>7</sup> This ANJOS 88C result assumes no interference between the DCS and mixing amplitudes ( $y' = 0$  in the note on " $D^0$ - $\bar{D}^0$  Mixing" near the start of the  $D^0$  Listings). When interference is allowed, the limit degrades to 0.019.

$\Gamma(K_S^0 \pi^+ \pi^- \text{ in } D^0 \rightarrow \bar{D}^0) / \Gamma(K_S^0 \pi^+ \pi^-)$   $\Gamma_{225} / \Gamma_{35}$

This is  $R_M$  in the note on " $D^0$ - $\bar{D}^0$  Mixing" near the start of the  $D^0$  Listings. The experiments here (1) use the charge of the pion in  $D^*(2010)^\pm \rightarrow (D^0 \text{ or } \bar{D}^0) \pi^\pm$  decay to tell whether a  $D^0$  or a  $\bar{D}^0$  was born; and (2) use the decay-time distribution to disentangle doubly Cabibbo-suppressed decay and mixing. For the limits on  $|m_1 - m_2|$  and  $(\Gamma_1 - \Gamma_2) / \Gamma$  that come from the best mixing limit, see near the beginning of these  $D^0$  Listings.

| VALUE             | CL% | DOCUMENT ID        | TECN | COMMENT                               |
|-------------------|-----|--------------------|------|---------------------------------------|
| <b>&lt;0.0063</b> | 95  | <sup>1</sup> ASNER | 05   | CLEO $e^+ e^- \approx 10 \text{ GeV}$ |

<sup>1</sup> This ASNER 05 limit allows  $CP$  violation. If  $CP$  violation is not allowed, the limit is 0.0042 at 95% CL.

$\Gamma(K^+ \pi^- \pi^0) / \Gamma(K^- \pi^+ \pi^0)$   $\Gamma_{229} / \Gamma_{50}$

The experiments here use the charge of the pion in  $D^*(2010)^\pm \rightarrow (D^0 \text{ or } \bar{D}^0) \pi^\pm$  decay to tell whether a  $D^0$  or a  $\bar{D}^0$  was born. The  $D^0 \rightarrow K^+ \pi^- \pi^0$  decay can occur directly by doubly Cabibbo-suppressed (DCS) decay, or indirectly by  $D^0 \rightarrow \bar{D}^0$  mixing followed by  $\bar{D}^0 \rightarrow K^+ \pi^- \pi^0$  decay.

| VALUE (units $10^{-3}$ )                        | EVTS       | DOCUMENT ID           | TECN | COMMENT                             |
|---|------------|-----------------------|------|-------------------------------------|
| <b>2.20 ± 0.10 OUR AVERAGE</b>                  |            |                       |      |                                     |
| 2.14 ± 0.08 ± 0.08                              | 763 ± 51   | <sup>1</sup> AUBERT,B | 06N  | BABR $e^+ e^- \approx \Upsilon(4S)$ |
| 2.29 ± 0.15 <sup>+0.13</sup> / <sub>-0.09</sub> | 1978 ± 104 | TIAN                  | 05   | BELL $e^+ e^- \approx \Upsilon(4S)$ |
| 4.3 <sup>+1.1</sup> / <sub>-1.0</sub> ± 0.7     | 38         | BRANDENB...           | 01   | CLE2 $e^+ e^- \approx \Upsilon(4S)$ |

<sup>1</sup> This AUBERT,B 06N result assumes no mixing.

$\Gamma(K^+ \pi^- \pi^0 \text{ via } \bar{D}^0) / \Gamma(K^- \pi^+ \pi^0)$   $\Gamma_{230} / \Gamma_{50}$

This is  $R_M$  in the note on " $D^0$ - $\bar{D}^0$  Mixing" near the start of the  $D^0$  Listings. The experiments here (1) use the charge of the pion in  $D^*(2010)^\pm \rightarrow (D^0 \text{ or } \bar{D}^0) \pi^\pm$  decay to tell whether a  $D^0$  or a  $\bar{D}^0$  was born; and (2) use the decay-time distribution to disentangle doubly Cabibbo-suppressed decay and mixing. For the limits on  $|m_1 - m_2|$  and  $(\Gamma_1 - \Gamma_2) / \Gamma$  that come from the best mixing limit, see near the beginning of these  $D^0$  Listings.

| VALUE (units $10^{-3}$ )                             | CL% | DOCUMENT ID | TECN | COMMENT                     |
|--|-----|-------------|------|-----------------------------|
| <b>5.25 <sup>+0.25</sup>/<sub>-0.31</sub> ± 0.12</b> |     | AUBERT      | 09AN | BABR $e^+ e^-$ at 10.58 GeV |

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

|       |    |                       |     |                                     |
|-------|----|-----------------------|-----|-------------------------------------|
| <0.54 | 95 | <sup>1</sup> AUBERT,B | 06N | BABR $e^+ e^- \approx \Upsilon(4S)$ |
|-------|----|-----------------------|-----|-------------------------------------|

<sup>1</sup>This AUBERT,B 06N limit assumes no  $CP$  violation. The measured value corresponding to the limit is  $(2.3_{-1.4}^{+1.8} \pm 0.4) \times 10^{-4}$ . If  $CP$  violation is allowed, this becomes  $(1.0_{-0.7}^{+2.2} \pm 0.3) \times 10^{-4}$ .

$\Gamma(K^+ \pi^+ 2\pi^-)/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{231}/\Gamma_{67}$

The experiments here use the charge of the pion in  $D^*(2010)^\pm \rightarrow (D^0 \text{ or } \bar{D}^0) \pi^\pm$  decay to tell whether a  $D^0$  or a  $\bar{D}^0$  was born. The  $D^0 \rightarrow K^+ \pi^- \pi^+ \pi^-$  decay can occur directly by doubly Cabibbo-suppressed (DCS) decay, or indirectly by  $D^0 \rightarrow \bar{D}^0$  mixing followed by  $\bar{D}^0 \rightarrow K^+ \pi^- \pi^+ \pi^-$  decay. Some of the experiments can use the decay-time information to disentangle the two mechanisms. Here, we list the experimental branching ratio, which if there is no mixing is the DCS ratio; in the next data block we give the limits on the mixing ratio.

Some early limits have been omitted from this Listing; see our 1998 edition (EPJ **C3** 1).

| VALUE (units $10^{-3}$ )       | CL% | EVTS          | DOCUMENT ID         | TECN    | COMMENT                        |
|--------------------------------|-----|---------------|---------------------|---------|--------------------------------|
| <b>3.25 ± 0.11 OUR AVERAGE</b> |     |               |                     |         |                                |
| $3.24 \pm 0.08 \pm 0.07$       |     | $3358 \pm 79$ | <sup>1</sup> WHITE  | 13 BELL | $e^+ e^- \approx \Upsilon(4S)$ |
| $4.4_{-1.2}^{+1.3} \pm 0.4$    |     | 54            | <sup>1</sup> DYTMAN | 01 CLE2 | $e^+ e^- \approx \Upsilon(4S)$ |
| $2.5_{-3.4}^{+3.6} \pm 0.3$    |     |               | <sup>2</sup> AITALA | 98 E791 | $\pi^-$ nucl., 500 GeV         |

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

|                                 |    |               |                    |          |                            |
|---------------------------------|----|---------------|--------------------|----------|----------------------------|
| $3.20 \pm 0.18_{-0.13}^{+0.18}$ |    | $1721 \pm 75$ | <sup>1</sup> TIAN  | 05 BELL  | See WHITE 13               |
| <18                             | 90 |               | <sup>1</sup> AMMAR | 91 CLEO  | $e^+ e^- \approx 10.5$ GeV |
| <18                             | 90 |               | <sup>3</sup> ANJOS | 88C E691 | Photoproduction            |

<sup>1</sup>AMMAR 91 cannot and DYTMAN 01, TIAN 05, and WHITE 13 do not distinguish between doubly Cabibbo-suppressed decay and  $D^0$ - $\bar{D}^0$  mixing.

<sup>2</sup>This AITALA 98 result assumes no  $D^0$ - $\bar{D}^0$  mixing ( $R_M$  in the note on “ $D^0$ - $\bar{D}^0$  Mixing”). It becomes  $-0.0020_{-0.0106}^{+0.0117} \pm 0.0035$  when mixing is allowed and decay-time information is used to distinguish doubly Cabibbo-suppressed decays from mixing.

<sup>3</sup>ANJOS 88C uses decay-time information to distinguish doubly Cabibbo-suppressed (DCS) decays from  $D^0$ - $\bar{D}^0$  mixing. However, the result assumes no interference between the DCS and mixing amplitudes ( $y' = 0$  in the note on “ $D^0$ - $\bar{D}^0$  Mixing” near the start of the  $D^0$  Listings). When interference is allowed, the limit degrades to 0.033.

$\Gamma(K^+ \pi^+ 2\pi^- \text{ via } \bar{D}^0)/\Gamma(K^- 2\pi^+ \pi^-)$   $\Gamma_{232}/\Gamma_{67}$

This is a  $D^0$ - $\bar{D}^0$  mixing limit. The experiments here (1) use the charge of the pion in  $D^*(2010)^\pm \rightarrow (D^0 \text{ or } \bar{D}^0) \pi^\pm$  decay to tell whether a  $D^0$  or a  $\bar{D}^0$  was born; and (2) use the decay-time distribution to disentangle doubly Cabibbo-suppressed decay and mixing. For the limits on  $|m_{D_1^0} - m_{D_2^0}|$  and  $(\Gamma_{D_1^0} - \Gamma_{D_2^0})/\Gamma_{D^0}$  that come from the best mixing limit, see near the beginning of these  $D^0$  Listings.

| VALUE            | CL% | DOCUMENT ID        | TECN     | COMMENT         |
|------------------|-----|--------------------|----------|-----------------|
| <b>&lt;0.005</b> | 90  | <sup>1</sup> ANJOS | 88C E691 | Photoproduction |

<sup>1</sup>ANJOS 88C uses decay-time information to distinguish doubly Cabibbo-suppressed (DCS) decays from  $D^0$ - $\bar{D}^0$  mixing. However, the result assumes no interference between the DCS and mixing amplitudes ( $y' = 0$  in the note on “ $D^0$ - $\bar{D}^0$  Mixing” near the start of the  $D^0$  Listings). When interference is allowed, the limit degrades to 0.007.

$\Gamma(K^+\pi^- \text{ or } K^+\pi^+2\pi^- \text{ via } \bar{D}^0)/\Gamma(K^-\pi^+ \text{ or } K^-2\pi^+\pi^-)$   $\Gamma_{233}/\Gamma_0$

This is a  $D^0-\bar{D}^0$  mixing limit. For the limits on  $|m_{D_1^0} - m_{D_2^0}|$  and  $(\Gamma_{D_1^0} - \Gamma_{D_2^0})/\Gamma_{D^0}$  that come from the best mixing limit, see near the beginning of these  $D^0$  Listings.

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|-------|-----|-------------|------|---------|
|-------|-----|-------------|------|---------|

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

|         |    |                     |          |                          |
|---------|----|---------------------|----------|--------------------------|
| <0.0085 | 90 | <sup>1</sup> AITALA | 98 E791  | $\pi^-$ nucleus, 500 GeV |
| <0.0037 | 90 | <sup>2</sup> ANJOS  | 88C E691 | Photoproduction          |

<sup>1</sup> AITALA 98 uses decay-time information to distinguish doubly Cabibbo-suppressed decays from  $D^0-\bar{D}^0$  mixing. The fit allows interference between the two amplitudes, and also allows  $CP$  violation in this term. The central value obtained is  $0.0039^{+0.0036}_{-0.0032} \pm 0.0016$ . When interference is disallowed, the result becomes  $0.0021 \pm 0.0009 \pm 0.0002$ .

<sup>2</sup> This combines results of ANJOS 88C on  $K^+\pi^-$  and  $K^+\pi^-\pi^+\pi^-$  (via  $\bar{D}^0$ ) reported in the data block above (see footnotes there). It assumes no interference.

$\Gamma(\mu^- \text{ anything via } \bar{D}^0)/\Gamma(\mu^+ \text{ anything})$   $\Gamma_{234}/\Gamma_6$

This is a  $D^0-\bar{D}^0$  mixing limit. See the somewhat better limits above.

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|-------|-----|-------------|------|---------|
|-------|-----|-------------|------|---------|

|                   |    |       |         |                   |
|-------------------|----|-------|---------|-------------------|
| <b>&lt;0.0056</b> | 90 | LOUIS | 86 SPEC | $\pi^-$ W 225 GeV |
|-------------------|----|-------|---------|-------------------|

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

|        |    |           |         |                                    |
|--------|----|-----------|---------|------------------------------------|
| <0.012 | 90 | BENVENUTI | 85 CNTR | $\mu$ C, 200 GeV                   |
| <0.044 | 90 | BODEK     | 82 SPEC | $\pi^-$ , $p$ Fe $\rightarrow D^0$ |

————— Rare or forbidden modes —————

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{235}/\Gamma$

$D^0 \rightarrow \gamma\gamma$  is a flavor-changing neutral-current decay, forbidden in the Standard Model at the tree level.

| VALUE (units $10^{-6}$ ) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|---------|
|--------------------------|-----|-------------|------|---------|

|                 |    |      |          |                            |
|-----------------|----|------|----------|----------------------------|
| <b>&lt; 2.2</b> | 90 | LEES | 12L BABR | $e^+e^- \approx 10.58$ GeV |
|-----------------|----|------|----------|----------------------------|

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

|     |    |      |         |                               |
|-----|----|------|---------|-------------------------------|
| <29 | 90 | COAN | 03 CLE2 | $e^+e^- \approx \Upsilon(4S)$ |
|-----|----|------|---------|-------------------------------|

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$   $\Gamma_{236}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by first-order weak interaction combined with electromagnetic interaction.

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|-------|-----|-------------|------|---------|
|-------|-----|-------------|------|---------|

|  |    |        |         |                               |
|--|----|--------|---------|-------------------------------|
| <b>&lt;7.9 <math>\times 10^{-8}</math></b> | 90 | PETRIC | 10 BELL | $e^+e^- \approx \Upsilon(4S)$ |
|--|----|--------|---------|-------------------------------|

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

|                        |    |            |          |                               |
|------------------------|----|------------|----------|-------------------------------|
| <1.7 $\times 10^{-7}$  | 90 | LEES       | 12Q BABR | $e^+e^- \approx 10.58$ GeV    |
| <1.2 $\times 10^{-6}$  | 90 | AUBERT,B   | 04Y BABR | $e^+e^- \approx \Upsilon(4S)$ |
| <8.19 $\times 10^{-6}$ | 90 | PRIPSTEIN  | 00 E789  | $p$ nucleus, 800 GeV          |
| <6.2 $\times 10^{-6}$  | 90 | AITALA     | 99G E791 | $\pi^- N$ 500 GeV             |
| <1.3 $\times 10^{-5}$  | 90 | FREYBERGER | 96 CLE2  | $e^+e^- \approx \Upsilon(4S)$ |
| <1.3 $\times 10^{-4}$  | 90 | ADLER      | 88 MRK3  | $e^+e^-$ 3.77 GeV             |
| <1.7 $\times 10^{-4}$  | 90 | ALBRECHT   | 88G ARG  | $e^+e^-$ 10 GeV               |
| <2.2 $\times 10^{-4}$  | 90 | HAAS       | 88 CLEO  | $e^+e^-$ 10 GeV               |

$\Gamma(\mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{237}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by first-order weak interaction combined with electromagnetic interaction.

| <u>VALUE</u>  | <u>CL%</u> | <u>DOCUMENT ID</u>  | <u>TECN</u> | <u>COMMENT</u>                      |
|---|------------|---------------------|-------------|-------------------------------------|
| <b>&lt;6.2 × 10<sup>-9</sup></b>  | 90         | AAIJ                | 13Al        | LHCB $pp$ at 7 TeV                  |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |            |                     |             |                                     |
| 0.6–8.1 × 10 <sup>-7</sup>  | 90         | <sup>1</sup> LEES   | 12Q         | BABR $e^+ e^- \approx 10.58$ GeV    |
| <2.1 × 10 <sup>-7</sup>   | 90         | AALTONEN            | 10X         | CDF $p\bar{p}, \sqrt{s} = 1.96$ TeV |
| <1.4 × 10 <sup>-7</sup>   | 90         | PETRIC              | 10          | BELL $e^+ e^- \approx \gamma(4S)$   |
| <2.0 × 10 <sup>-6</sup>   | 90         | ABT                 | 04          | HERB $pA, 920$ GeV                  |
| <1.3 × 10 <sup>-6</sup>   | 90         | AUBERT,B            | 04Y         | BABR $e^+ e^- \approx \gamma(4S)$   |
| <2.5 × 10 <sup>-6</sup>   | 90         | ACOSTA              | 03F         | CDF See AALTONEN 10X                |
| <1.56 × 10 <sup>-5</sup>  | 90         | PRIPSTEIN           | 00          | E789 $p$ nucleus, 800 GeV           |
| <5.2 × 10 <sup>-6</sup>   | 90         | AITALA              | 99G         | E791 $\pi^- N$ 500 GeV              |
| <4.1 × 10 <sup>-6</sup>   | 90         | ADAMOVICH           | 97          | BEAT $\pi^-$ Cu, W 350 GeV          |
| <4.2 × 10 <sup>-6</sup>   | 90         | ALEXOPOU...         | 96          | E771 $p$ Si, 800 GeV                |
| <3.4 × 10 <sup>-5</sup>   | 90         | FREYBERGER          | 96          | CLE2 $e^+ e^- \approx \gamma(4S)$   |
| <7.6 × 10 <sup>-6</sup>   | 90         | ADAMOVICH           | 95          | BEAT See ADAMOVICH 97               |
| <4.4 × 10 <sup>-5</sup>   | 90         | KODAMA              | 95          | E653 $\pi^-$ emulsion 600 GeV       |
| <3.1 × 10 <sup>-5</sup>   | 90         | <sup>2</sup> MISHRA | 94          | E789 $-4.1 \pm 4.8$ events          |
| <7.0 × 10 <sup>-5</sup>   | 90         | ALBRECHT            | 88G         | ARG $e^+ e^-$ 10 GeV                |
| <1.1 × 10 <sup>-5</sup>   | 90         | LOUIS               | 86          | SPEC $\pi^- W$ 225 GeV              |
| <3.4 × 10 <sup>-4</sup>   | 90         | AUBERT              | 85          | EMC Deep inelast. $\mu^- N$         |

<sup>1</sup> LEES 12Q gives a 2-sided range.

<sup>2</sup> Here MISHRA 94 uses "the statistical approach advocated by the PDG." For an alternate approach, giving a limit of  $9 \times 10^{-6}$  at 90% confidence level, see the paper.

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{238}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| <u>VALUE</u>                     | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                    |
|----------------------------------|------------|--------------------|-------------|-----------------------------------|
| <b>&lt;4.5 × 10<sup>-5</sup></b> | 90         | FREYBERGER         | 96          | CLE2 $e^+ e^- \approx \gamma(4S)$ |

$\Gamma(\pi^0 \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{239}/\Gamma$

A test for the  $\Delta C=1$  weak neutral current. Allowed by higher-order electroweak interactions.

| <u>VALUE</u>  | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                    |
|---|------------|--------------------|-------------|-----------------------------------|
| <b>&lt;1.8 × 10<sup>-4</sup></b>  | 90         | KODAMA             | 95          | E653 $\pi^-$ emulsion 600 GeV     |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |            |                    |             |                                   |
| <5.4 × 10 <sup>-4</sup>   | 90         | FREYBERGER         | 96          | CLE2 $e^+ e^- \approx \gamma(4S)$ |

$\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{240}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| <u>VALUE</u>                     | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                    |
|----------------------------------|------------|--------------------|-------------|-----------------------------------|
| <b>&lt;1.1 × 10<sup>-4</sup></b> | 90         | FREYBERGER         | 96          | CLE2 $e^+ e^- \approx \gamma(4S)$ |

$\Gamma(\eta\mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_{241}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                 | CL% | DOCUMENT ID   | TECN | COMMENT                       |
|-----------------------|-----|---------------|------|-------------------------------|
| $<5.3 \times 10^{-4}$ | 90  | FREYBERGER 96 | CLE2 | $e^+e^- \approx \Upsilon(4S)$ |

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma_{\text{total}}$   $\Gamma_{242}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                  | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|------------------------|-----|-------------|----------|--------------------------|
| $<3.73 \times 10^{-4}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(\rho^0e^+e^-)/\Gamma_{\text{total}}$   $\Gamma_{243}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                 | CL% | DOCUMENT ID                | TECN | COMMENT                       |
|-----------------------|-----|----------------------------|------|-------------------------------|
| $<1.0 \times 10^{-4}$ | 90  | <sup>1</sup> FREYBERGER 96 | CLE2 | $e^+e^- \approx \Upsilon(4S)$ |

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

|                        |    |        |          |                          |
|------------------------|----|--------|----------|--------------------------|
| $<1.24 \times 10^{-4}$ | 90 | AITALA | 01C E791 | $\pi^-$ nucleus, 500 GeV |
| $<4.5 \times 10^{-4}$  | 90 | HAAS   | 88 CLEO  | $e^+e^-$ 10 GeV          |

<sup>1</sup> This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 1.8 \times 10^{-4}$  using a photon pole amplitude model.

$\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_{244}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                 | CL% | DOCUMENT ID       | TECN     | COMMENT       |
|-----------------------|-----|-------------------|----------|---------------|
| $<5.5 \times 10^{-7}$ | 90  | <sup>1</sup> AAIJ | 14B LHCB | $pp$ at 7 TeV |

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

|                       |    |        |          |                          |
|-----------------------|----|--------|----------|--------------------------|
| $<3.0 \times 10^{-5}$ | 90 | AITALA | 01C E791 | $\pi^-$ nucleus, 500 GeV |
|-----------------------|----|--------|----------|--------------------------|

<sup>1</sup> AAIJ 14B measures this branching-fraction limit relative to the  $\pi^+\pi^-\phi$ ,  $\phi \rightarrow \mu^+\mu^-$  fraction. The above limit excludes the resonant  $\phi$ ,  $\omega$ , and  $\rho$  regions, and then fills those gaps with a phase-space model.

$\Gamma(\rho^0\mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_{245}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                 | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|-----------------------|-----|-------------|----------|--------------------------|
| $<2.2 \times 10^{-5}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

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

|                       |    |                            |         |                               |
|-----------------------|----|----------------------------|---------|-------------------------------|
| $<4.9 \times 10^{-4}$ | 90 | <sup>1</sup> FREYBERGER 96 | CLE2    | $e^+e^- \approx \Upsilon(4S)$ |
| $<2.3 \times 10^{-4}$ | 90 | KODAMA                     | 95 E653 | $\pi^-$ emulsion 600 GeV      |
| $<8.1 \times 10^{-4}$ | 90 | HAAS                       | 88 CLEO | $e^+e^-$ 10 GeV               |

<sup>1</sup> This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 4.5 \times 10^{-4}$  using a photon pole amplitude model.

$\Gamma(\omega e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{246}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                 | CL% | DOCUMENT ID                | TECN | COMMENT                      |
|-----------------------|-----|----------------------------|------|------------------------------|
| $<1.8 \times 10^{-4}$ | 90  | <sup>1</sup> FREYBERGER 96 | CLE2 | $e^+ e^- \approx \gamma(4S)$ |

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 2.7 \times 10^{-4}$  using a photon pole amplitude model.

$\Gamma(\omega \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{247}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                 | CL% | DOCUMENT ID                | TECN | COMMENT                      |
|-----------------------|-----|----------------------------|------|------------------------------|
| $<8.3 \times 10^{-4}$ | 90  | <sup>1</sup> FREYBERGER 96 | CLE2 | $e^+ e^- \approx \gamma(4S)$ |

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 6.5 \times 10^{-4}$  using a photon pole amplitude model.

$\Gamma(K^- K^+ e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{248}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                  | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|------------------------|-----|-------------|----------|--------------------------|
| $<3.15 \times 10^{-4}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(\phi e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{249}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                 | CL% | DOCUMENT ID                | TECN | COMMENT                      |
|-----------------------|-----|----------------------------|------|------------------------------|
| $<5.2 \times 10^{-5}$ | 90  | <sup>1</sup> FREYBERGER 96 | CLE2 | $e^+ e^- \approx \gamma(4S)$ |

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

|                       |    |        |          |                          |
|-----------------------|----|--------|----------|--------------------------|
| $<5.9 \times 10^{-5}$ | 90 | AITALA | 01C E791 | $\pi^-$ nucleus, 500 GeV |
|-----------------------|----|--------|----------|--------------------------|

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 7.6 \times 10^{-5}$  using a photon pole amplitude model.

$\Gamma(K^- K^+ \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{250}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                 | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|-----------------------|-----|-------------|----------|--------------------------|
| $<3.3 \times 10^{-5}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(\phi \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{251}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                 | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|-----------------------|-----|-------------|----------|--------------------------|
| $<3.1 \times 10^{-5}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

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

|                       |    |                            |      |                              |
|-----------------------|----|----------------------------|------|------------------------------|
| $<4.1 \times 10^{-4}$ | 90 | <sup>1</sup> FREYBERGER 96 | CLE2 | $e^+ e^- \approx \gamma(4S)$ |
|-----------------------|----|----------------------------|------|------------------------------|

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 2.4 \times 10^{-4}$  using a photon pole amplitude model.



$\Gamma(\bar{K}^0 e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{252}/\Gamma$

Not a useful test for  $\Delta C = 1$  weak neutral current because both quarks must change flavor.

| VALUE   | CL% | DOCUMENT ID   | TECN     | COMMENT                      |
|---|-----|---------------|----------|------------------------------|
| $<1.1 \times 10^{-4}$   | 90  | FREYBERGER 96 | CLE2     | $e^+ e^- \approx \gamma(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |               |          |                              |
| $<1.7 \times 10^{-3}$   | 90  | ADLER         | 89C MRK3 | $e^+ e^-$ 3.77 GeV           |

$\Gamma(\bar{K}^0 \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{253}/\Gamma$

Not a useful test for  $\Delta C = 1$  weak neutral current because both quarks must change flavor.

| VALUE   | CL% | DOCUMENT ID   | TECN    | COMMENT                      |
|---|-----|---------------|---------|------------------------------|
| $<2.6 \times 10^{-4}$   | 90  | KODAMA        | 95 E653 | $\pi^-$ emulsion 600 GeV     |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |               |         |                              |
| $<6.7 \times 10^{-4}$   | 90  | FREYBERGER 96 | CLE2    | $e^+ e^- \approx \gamma(4S)$ |

$\Gamma(K^- \pi^+ e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{254}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                  | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|------------------------|-----|-------------|----------|--------------------------|
| $<3.85 \times 10^{-4}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(\bar{K}^*(892)^0 e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{255}/\Gamma$

Not a useful test for  $\Delta C = 1$  weak neutral current because both quarks must change flavor.

| VALUE   | CL% | DOCUMENT ID                | TECN     | COMMENT                      |
|---|-----|----------------------------|----------|------------------------------|
| $<4.7 \times 10^{-5}$   | 90  | AITALA                     | 01C E791 | $\pi^-$ nucleus, 500 GeV     |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |                            |          |                              |
| $<1.4 \times 10^{-4}$   | 90  | <sup>1</sup> FREYBERGER 96 | CLE2     | $e^+ e^- \approx \gamma(4S)$ |

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 2.0 \times 10^{-4}$  using a photon pole amplitude model.

$\Gamma(K^- \pi^+ \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{256}/\Gamma$

A test for the  $\Delta C = 1$  weak neutral current. Allowed by higher-order electroweak interactions.

| VALUE                  | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|------------------------|-----|-------------|----------|--------------------------|
| $<3.59 \times 10^{-4}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(\bar{K}^*(892)^0 \mu^+ \mu^-)/\Gamma_{\text{total}}$   $\Gamma_{257}/\Gamma$

Not a useful test for  $\Delta C = 1$  weak neutral current because both quarks must change flavor.

| VALUE   | CL% | DOCUMENT ID                | TECN     | COMMENT                      |
|---|-----|----------------------------|----------|------------------------------|
| $<2.4 \times 10^{-5}$   | 90  | AITALA                     | 01C E791 | $\pi^-$ nucleus, 500 GeV     |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |     |                            |          |                              |
| $<1.18 \times 10^{-3}$  | 90  | <sup>1</sup> FREYBERGER 96 | CLE2     | $e^+ e^- \approx \gamma(4S)$ |

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 1.0 \times 10^{-3}$  using a photon pole amplitude model.

$\Gamma(\pi^+\pi^-\pi^0\mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_{258}/\Gamma$

A test for the  $\Delta C=1$  weak neutral current. Allowed by higher-order electroweak interactions.

| <u>VALUE</u>           | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|------------------------|------------|--------------------|-------------|--------------------------|
| $< 8.1 \times 10^{-4}$ | 90         | KODAMA             | 95 E653     | $\pi^-$ emulsion 600 GeV |

$\Gamma(\mu^\pm e^\mp)/\Gamma_{\text{total}}$   $\Gamma_{259}/\Gamma$

A test of lepton family number conservation.

| <u>VALUE</u>  | <u>CL%</u> | <u>DOCUMENT ID</u>      | <u>TECN</u> | <u>COMMENT</u>                |
|---|------------|-------------------------|-------------|-------------------------------|
| $< 2.6 \times 10^{-7}$  | 90         | PETRIC                  | 10 BELL     | $e^+e^- \approx \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |            |                         |             |                               |
| $< 3.3 \times 10^{-7}$  | 90         | LEES                    | 12Q BABR    | $e^+e^- \approx 10.58$ GeV    |
| $< 8.1 \times 10^{-7}$  | 90         | AUBERT,B                | 04Y BABR    | $e^+e^- \approx \Upsilon(4S)$ |
| $< 1.72 \times 10^{-5}$   | 90         | PRIPSTEIN               | 00 E789     | $p$ nucleus, 800 GeV          |
| $< 8.1 \times 10^{-6}$  | 90         | AITALA                  | 99G E791    | $\pi^- N$ 500 GeV             |
| $< 1.9 \times 10^{-5}$  | 90         | <sup>1</sup> FREYBERGER | 96 CLE2     | $e^+e^- \approx \Upsilon(4S)$ |
| $< 1.0 \times 10^{-4}$  | 90         | ALBRECHT                | 88G ARG     | $e^+e^-$ 10 GeV               |
| $< 2.7 \times 10^{-4}$  | 90         | HAAS                    | 88 CLEO     | $e^+e^-$ 10 GeV               |
| $< 1.2 \times 10^{-4}$  | 90         | BECKER                  | 87C MRK3    | $e^+e^-$ 3.77 GeV             |
| $< 9 \times 10^{-4}$  | 90         | PALKA                   | 87 SILI     | 200 GeV $\pi p$               |
| $< 21 \times 10^{-4}$   | 90         | <sup>2</sup> RILES      | 87 MRK2     | $e^+e^-$ 29 GeV               |

<sup>1</sup>This is the corrected result given in the erratum to FREYBERGER 96.

<sup>2</sup>RILES 87 assumes  $B(D \rightarrow K\pi) = 3.0\%$  and has production model dependency.

$\Gamma(\pi^0 e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{260}/\Gamma$

A test of lepton family number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>           | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                |
|------------------------|------------|--------------------|-------------|-------------------------------|
| $< 8.6 \times 10^{-5}$ | 90         | FREYBERGER         | 96 CLE2     | $e^+e^- \approx \Upsilon(4S)$ |

$\Gamma(\eta e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{261}/\Gamma$

A test of lepton family number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>           | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                |
|------------------------|------------|--------------------|-------------|-------------------------------|
| $< 1.0 \times 10^{-4}$ | 90         | FREYBERGER         | 96 CLE2     | $e^+e^- \approx \Upsilon(4S)$ |

$\Gamma(\pi^+\pi^- e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{262}/\Gamma$

A test of lepton family-number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>           | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|------------------------|------------|--------------------|-------------|--------------------------|
| $< 1.5 \times 10^{-5}$ | 90         | AITALA             | 01C E791    | $\pi^-$ nucleus, 500 GeV |

$\Gamma(\rho^0 e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{263}/\Gamma$

A test of lepton family number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>           | <u>CL%</u> | <u>DOCUMENT ID</u>      | <u>TECN</u> | <u>COMMENT</u>                |
|------------------------|------------|-------------------------|-------------|-------------------------------|
| $< 4.9 \times 10^{-5}$ | 90         | <sup>1</sup> FREYBERGER | 96 CLE2     | $e^+e^- \approx \Upsilon(4S)$ |

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

|                        |    |        |          |                          |
|------------------------|----|--------|----------|--------------------------|
| $< 6.6 \times 10^{-5}$ | 90 | AITALA | 01C E791 | $\pi^-$ nucleus, 500 GeV |
|------------------------|----|--------|----------|--------------------------|

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 5.0 \times 10^{-5}$  using a photon pole amplitude model.

$\Gamma(\omega e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{264}/\Gamma$

A test of lepton family number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>          | <u>CL%</u> | <u>DOCUMENT ID</u>         | <u>TECN</u> | <u>COMMENT</u>               |
|-----------------------|------------|----------------------------|-------------|------------------------------|
| $<1.2 \times 10^{-4}$ | 90         | <sup>1</sup> FREYBERGER 96 | CLE2        | $e^+ e^- \approx \gamma(4S)$ |

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The same limit is obtained using a photon pole amplitude model.

$\Gamma(K^- K^+ e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{265}/\Gamma$

A test of lepton family-number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>          | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|-----------------------|------------|--------------------|-------------|--------------------------|
| $<1.8 \times 10^{-4}$ | 90         | AITALA             | 01C E791    | $\pi^-$ nucleus, 500 GeV |

$\Gamma(\phi e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{266}/\Gamma$

A test of lepton family number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>          | <u>CL%</u> | <u>DOCUMENT ID</u>         | <u>TECN</u> | <u>COMMENT</u>               |
|-----------------------|------------|----------------------------|-------------|------------------------------|
| $<3.4 \times 10^{-5}$ | 90         | <sup>1</sup> FREYBERGER 96 | CLE2        | $e^+ e^- \approx \gamma(4S)$ |

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

|                       |    |        |          |                          |
|-----------------------|----|--------|----------|--------------------------|
| $<4.7 \times 10^{-5}$ | 90 | AITALA | 01C E791 | $\pi^-$ nucleus, 500 GeV |
|-----------------------|----|--------|----------|--------------------------|

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The limit changes to  $< 3.3 \times 10^{-5}$  using a photon pole amplitude model.

$\Gamma(\bar{K}^0 e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{267}/\Gamma$

A test of lepton family number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>          | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>               |
|-----------------------|------------|--------------------|-------------|------------------------------|
| $<1.0 \times 10^{-4}$ | 90         | FREYBERGER 96      | CLE2        | $e^+ e^- \approx \gamma(4S)$ |

$\Gamma(K^- \pi^+ e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{268}/\Gamma$

A test of lepton family-number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>           | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|------------------------|------------|--------------------|-------------|--------------------------|
| $<5.53 \times 10^{-4}$ | 90         | AITALA             | 01C E791    | $\pi^-$ nucleus, 500 GeV |

$\Gamma(\bar{K}^*(892)^0 e^\pm \mu^\mp)/\Gamma_{\text{total}}$   $\Gamma_{269}/\Gamma$

A test of lepton family number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>          | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|-----------------------|------------|--------------------|-------------|--------------------------|
| $<8.3 \times 10^{-5}$ | 90         | AITALA             | 01C E791    | $\pi^-$ nucleus, 500 GeV |

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

|                       |    |                            |      |                              |
|-----------------------|----|----------------------------|------|------------------------------|
| $<1.0 \times 10^{-4}$ | 90 | <sup>1</sup> FREYBERGER 96 | CLE2 | $e^+ e^- \approx \gamma(4S)$ |
|-----------------------|----|----------------------------|------|------------------------------|

<sup>1</sup>This FREYBERGER 96 limit is obtained using a phase-space model. The same limit is obtained using a photon pole amplitude model.

$\Gamma(2\pi^- 2e^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{270}/\Gamma$

A test of lepton-number conservation. The value is for the sum of the two charge states.

| <u>VALUE</u>           | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>           |
|------------------------|------------|--------------------|-------------|--------------------------|
| $<1.12 \times 10^{-4}$ | 90         | AITALA             | 01C E791    | $\pi^-$ nucleus, 500 GeV |

$\Gamma(2\pi^- 2\mu^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{271}/\Gamma$

A test of lepton-number conservation. The value is for the sum of the two charge states.

| VALUE                 | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|-----------------------|-----|-------------|----------|--------------------------|
| $<2.9 \times 10^{-5}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(K^- \pi^- 2e^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{272}/\Gamma$

A test of lepton-number conservation. The value is for the sum of the two charge states.

| VALUE                  | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|------------------------|-----|-------------|----------|--------------------------|
| $<2.06 \times 10^{-4}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(K^- \pi^- 2\mu^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{273}/\Gamma$

A test of lepton-number conservation. The value is for the sum of the two charge states.

| VALUE                 | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|-----------------------|-----|-------------|----------|--------------------------|
| $<3.9 \times 10^{-4}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(2K^- 2e^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{274}/\Gamma$

A test of lepton-number conservation. The value is for the sum of the two charge states.

| VALUE                  | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|------------------------|-----|-------------|----------|--------------------------|
| $<1.52 \times 10^{-4}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(2K^- 2\mu^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{275}/\Gamma$

A test of lepton-number conservation. The value is for the sum of the two charge states.

| VALUE                 | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|-----------------------|-----|-------------|----------|--------------------------|
| $<9.4 \times 10^{-5}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(\pi^- \pi^- e^+ \mu^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{276}/\Gamma$

A test of lepton-number conservation. The value is for the sum of the two charge states.

| VALUE                 | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|-----------------------|-----|-------------|----------|--------------------------|
| $<7.9 \times 10^{-5}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(K^- \pi^- e^+ \mu^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{277}/\Gamma$

A test of lepton-number conservation. The value is for the sum of the two charge states.

| VALUE                  | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|------------------------|-----|-------------|----------|--------------------------|
| $<2.18 \times 10^{-4}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(2K^- e^+ \mu^+ + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{278}/\Gamma$

A test of lepton-number conservation. The value is for the sum of the two charge states.

| VALUE                 | CL% | DOCUMENT ID | TECN     | COMMENT                  |
|-----------------------|-----|-------------|----------|--------------------------|
| $<5.7 \times 10^{-5}$ | 90  | AITALA      | 01C E791 | $\pi^-$ nucleus, 500 GeV |

$\Gamma(pe^-)/\Gamma_{\text{total}}$   $\Gamma_{279}/\Gamma$

A test of baryon- and lepton-number conservation.

| VALUE                 | CL% | DOCUMENT ID        | TECN    | COMMENT                   |
|-----------------------|-----|--------------------|---------|---------------------------|
| $<1.0 \times 10^{-5}$ | 90  | <sup>1</sup> RUBIN | 09 CLEO | $e^+ e^-$ at $\psi(3770)$ |

<sup>1</sup> This RUBIN 09 limit is for either  $D^0 \rightarrow p e^-$  or  $\bar{D}^0 \rightarrow p e^-$  decay.

$\Gamma(\bar{p}e^+)/\Gamma_{\text{total}}$

$\Gamma_{280}/\Gamma$

A test of baryon- and lepton-number conservation.

| VALUE                 | CL% | DOCUMENT ID           | TECN | COMMENT                  |
|-----------------------|-----|-----------------------|------|--------------------------|
| $<1.1 \times 10^{-5}$ | 90  | <sup>1</sup> RUBIN 09 | CLEO | $e^+e^-$ at $\psi(3770)$ |

<sup>1</sup> This RUBIN 09 limit is for either  $D^0 \rightarrow \bar{p}e^+$  or  $\bar{D}^0 \rightarrow \bar{p}e^+$  decay.

**$D^0$  CP-VIOLATING DECAY-RATE ASYMMETRIES**

This is the difference between  $D^0$  and  $\bar{D}^0$  partial widths for the decay to state  $f$ , divided by the sum of the widths:

$$A_{CP}(f) = [\Gamma(D^0 \rightarrow f) - \Gamma(\bar{D}^0 \rightarrow \bar{f})] / [\Gamma(D^0 \rightarrow f) + \Gamma(\bar{D}^0 \rightarrow \bar{f})].$$

**$A_{CP}(K^+K^-)$  in  $D^0, \bar{D}^0 \rightarrow K^+K^-$**

| VALUE (%)                       | EVTS | DOCUMENT ID           | TECN      | COMMENT                             |
|---------------------------------|------|-----------------------|-----------|-------------------------------------|
| <b>-0.14 ± 0.12 OUR AVERAGE</b> |      |                       |           |                                     |
| -0.06 ± 0.15 ± 0.10             | 1.8M | <sup>1</sup> AAIJ     | 14AK LHCb | Time-integrated                     |
| -0.24 ± 0.22 ± 0.09             | 476k | <sup>1</sup> AALTONEN | 12B CDF   | $p\bar{p}$ , $\sqrt{s}=1.96$ TeV    |
| 0.00 ± 0.34 ± 0.13              | 129k | <sup>2</sup> AUBERT   | 08M BABR  | $e^+e^- \approx 10.6$ GeV           |
| -0.43 ± 0.30 ± 0.11             | 120k | <sup>3</sup> STARIC   | 08 BELL   | $e^+e^- \approx \Upsilon(4S)$       |
| +2.0 ± 1.2 ± 0.6                |      | <sup>4</sup> ACOSTA   | 05C CDF   | $p\bar{p}$ , $\sqrt{s}=1.96$ TeV    |
| 0.0 ± 2.2 ± 0.8                 | 3023 | <sup>4</sup> CSORNA   | 02 CLE2   | $e^+e^- \approx \Upsilon(4S)$       |
| -0.1 ± 2.2 ± 1.5                | 3330 | <sup>4</sup> LINK     | 00B FOCS  |                                     |
| -1.0 ± 4.9 ± 1.2                | 609  | <sup>4</sup> AITALA   | 98C E791  | $-0.093 < A_{CP} < +0.073$ (90% CL) |

<sup>1</sup> See also "  $D^0$  CP-violating asymmetry differences" at the end of the CP-violating asymmetries.

<sup>2</sup> AUBERT 08M uses corrected numbers of events directly, not ratios with  $K^\mp \pi^\pm$  events.

<sup>3</sup> STARIC 08 uses  $D^0 \rightarrow K^- \pi^+$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$  decays to correct for detector-induced asymmetries.

<sup>4</sup> AITALA 98C, LINK 00B, CSORNA 02, and ACOSTA 05C measure  $N(D^0 \rightarrow K^+K^-)/N(D^0 \rightarrow K^- \pi^+)$ , the ratio of numbers of events observed, and similarly for the  $\bar{D}^0$ .

**$A_{CP}(K_S^0 K_S^0)$  in  $D^0, \bar{D}^0 \rightarrow K_S^0 K_S^0$**

| VALUE (%)       | EVTS | DOCUMENT ID  | TECN | COMMENT                   |
|-----------------|------|--------------|------|---------------------------|
| <b>-23 ± 19</b> | 65   | BONVICINI 01 | CLE2 | $e^+e^- \approx 10.6$ GeV |

**$A_{CP}(\pi^+ \pi^-)$  in  $D^0, \bar{D}^0 \rightarrow \pi^+ \pi^-$**

| VALUE (%)                      | EVTS  | DOCUMENT ID           | TECN      | COMMENT                             |
|--------------------------------|-------|-----------------------|-----------|-------------------------------------|
| <b>0.01 ± 0.15 OUR AVERAGE</b> |       |                       |           |                                     |
| -0.20 ± 0.19 ± 0.10            | 774k  | <sup>1,2</sup> AAIJ   | 14AK LHCb | Time-integrated                     |
| 0.22 ± 0.24 ± 0.11             | 215k  | <sup>1</sup> AALTONEN | 12B CDF   | $p\bar{p}$ , $\sqrt{s}=1.96$ TeV    |
| -0.24 ± 0.52 ± 0.22            | 63.7k | <sup>3</sup> AUBERT   | 08M BABR  | $e^+e^- \approx 10.6$ GeV           |
| 0.43 ± 0.52 ± 0.12             | 51k   | <sup>4</sup> STARIC   | 08 BELL   | $e^+e^- \approx \Upsilon(4S)$       |
| 1.0 ± 1.3 ± 0.6                |       | <sup>5</sup> ACOSTA   | 05C CDF   | $p\bar{p}$ , $\sqrt{s}=1.96$ TeV    |
| 1.9 ± 3.2 ± 0.8                | 1136  | <sup>5</sup> CSORNA   | 02 CLE2   | $e^+e^- \approx \Upsilon(4S)$       |
| 4.8 ± 3.9 ± 2.5                | 1177  | <sup>5</sup> LINK     | 00B FOCS  |                                     |
| -4.9 ± 7.8 ± 3.0               | 343   | <sup>5</sup> AITALA   | 98C E791  | $-0.186 < A_{CP} < +0.088$ (90% CL) |

- <sup>1</sup> See also "  $D^0$   $CP$ -violating asymmetry differences" at the end of the  $CP$ -violating asymmetries.  
<sup>2</sup> AAIJ 14AK uses  $\Delta A_{CP}(\pi\pi, KK)$  and  $A_{CP}(KK)$  reported in the same paper.  
<sup>3</sup> AUBERT 08M uses corrected numbers of events directly, not ratios with  $K^\mp \pi^\pm$  events.  
<sup>4</sup> STARIC 08 uses  $D^0 \rightarrow K^- \pi^+$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$  decays to correct for detector-induced asymmetries.  
<sup>5</sup> AITALA 98C, LINK 00B, CSORNA 02, and ACOSTA 05C measure  $N(D^0 \rightarrow \pi^+ \pi^-)/N(D^0 \rightarrow K^- \pi^+)$ , the ratio of numbers of events observed, and similarly for the  $\bar{D}^0$ .

**$A_{CP}(\pi^0 \pi^0)$  in  $D^0, \bar{D}^0 \rightarrow \pi^0 \pi^0$**

| VALUE (%)                    | EVTS | DOCUMENT ID | TECN | COMMENT                              |
|------------------------------|------|-------------|------|--------------------------------------|
| <b>0.0 ± 0.6 OUR AVERAGE</b> |      |             |      |                                      |
| -0.03 ± 0.64 ± 0.10          | 34k  | NISAR       | 14   | BELL $e^+ e^-$ at/near $\Upsilon$ 's |
| 0.1 ± 4.8                    | 810  | BONVICINI   | 01   | CLE2 $e^+ e^- \approx 10.6$ GeV      |

**$A_{CP}(\pi^+ \pi^- \pi^0)$  in  $D^0, \bar{D}^0 \rightarrow \pi^+ \pi^- \pi^0$**

| VALUE (%)  | EVTS       | DOCUMENT ID         | TECN      | COMMENT                             |
|--|------------|---------------------|-----------|-------------------------------------|
| <b>0.3 ± 0.4 OUR AVERAGE</b>                             |            |                     |           |                                     |
| 0.43 ± 1.30  | 123k ± 490 | ARINSTEIN           | 08        | BELL $e^+ e^- \approx \Upsilon(4S)$ |
| 0.31 ± 0.41 ± 0.17                                       | 80 ± .3k   | <sup>1</sup> AUBERT | 08AO BABR | $e^+ e^- \approx 10.6$ GeV          |
| 1 $\begin{smallmatrix} +9 \\ -7 \end{smallmatrix} \pm 5$ |            | CRONIN-HEN..05      | CLEO      | $e^+ e^- \approx 10$ GeV            |

<sup>1</sup> AUBERT 08AO report their result using a different sign convention.

**$A_{CP}(\rho(770)^+ \pi^- \rightarrow \pi^+ \pi^- \pi^0)$  in  $D^0 \rightarrow \rho^+ \pi^-, \bar{D}^0 \rightarrow \rho^- \pi^+$**

| VALUE (%)               | DOCUMENT ID | TECN      | COMMENT                   |
|-------------------------|-------------|-----------|---------------------------|
| <b>+1.2 ± 0.8 ± 0.3</b> | AUBERT      | 08AO BABR | Table 1, -Col.5/2 × Col.2 |

**$A_{CP}(\rho(770)^0 \pi^0 \rightarrow \pi^+ \pi^- \pi^0)$  in  $D^0, \bar{D}^0 \rightarrow \rho^0 \pi^0$**

| VALUE (%)               | DOCUMENT ID | TECN      | COMMENT                   |
|-------------------------|-------------|-----------|---------------------------|
| <b>-3.1 ± 2.7 ± 1.2</b> | AUBERT      | 08AO BABR | Table 1, -Col.5/2 × Col.2 |

**$A_{CP}(\rho(770)^- \pi^+ \rightarrow \pi^+ \pi^- \pi^0)$  in  $D^0 \rightarrow \rho^- \pi^+, \bar{D}^0 \rightarrow \rho^+ \pi^-$**

| VALUE (%)               | DOCUMENT ID | TECN      | COMMENT                   |
|-------------------------|-------------|-----------|---------------------------|
| <b>-1.0 ± 1.6 ± 0.7</b> | AUBERT      | 08AO BABR | Table 1, -Col.5/2 × Col.2 |

**$A_{CP}(\rho(1450)^+ \pi^- \rightarrow \pi^+ \pi^- \pi^0)$  in  $D^0 \rightarrow \rho(1450)^+ \pi^-, \bar{D}^0 \rightarrow \text{c.c.}$**

| VALUE (%)          | DOCUMENT ID | TECN      | COMMENT                   |
|--------------------|-------------|-----------|---------------------------|
| <b>0 ± 50 ± 50</b> | AUBERT      | 08AO BABR | Table 1, -Col.5/2 × Col.2 |

**$A_{CP}(\rho(1450)^0 \pi^0 \rightarrow \pi^+ \pi^- \pi^0)$  in  $D^0, \bar{D}^0 \rightarrow \rho(1450)^0 \pi^0$**

| VALUE (%)            | DOCUMENT ID | TECN      | COMMENT                   |
|----------------------|-------------|-----------|---------------------------|
| <b>-17 ± 33 ± 17</b> | AUBERT      | 08AO BABR | Table 1, -Col.5/2 × Col.2 |

**$A_{CP}(\rho(1450)^- \pi^+ \rightarrow \pi^+ \pi^- \pi^0)$  in  $D^0 \rightarrow \rho(1450)^- \pi^+, \bar{D}^0 \rightarrow \text{c.c.}$**

| VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                   |
|-------------------|-------------|-----------|---------------------------|
| <b>+6 ± 8 ± 3</b> | AUBERT      | 08AO BABR | Table 1, -Col.5/2 × Col.2 |

| $A_{CP}(\rho(1700)^+ \pi^- \rightarrow \pi^+ \pi^- \pi^0)$ in $D^0 \rightarrow \rho(1700)^+ \pi^-, \bar{D}^0 \rightarrow \text{c.c.}$ | VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                 |
|---|-------------------|-------------|-----------|-------------------------|
|   | $-5 \pm 13 \pm 5$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(\rho(1700)^0 \pi^0 \rightarrow \pi^+ \pi^- \pi^0)$ in $D^0, \bar{D}^0 \rightarrow \rho(1700)^0 \pi^0$ | VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                 |
|---|-------------------|-------------|-----------|-------------------------|
|   | $+13 \pm 8 \pm 3$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(\rho(1700)^- \pi^+ \rightarrow \pi^+ \pi^- \pi^0)$ in $D^0 \rightarrow \rho(1700)^- \pi^+, \bar{D}^0 \rightarrow \text{c.c.}$ | VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                 |
|---|-------------------|-------------|-----------|-------------------------|
|   | $+8 \pm 10 \pm 5$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(f_0(980) \pi^0 \rightarrow \pi^+ \pi^- \pi^0)$ in $D^0, \bar{D}^0 \rightarrow f_0(980) \pi^0$ | VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                 |
|---|-------------------|-------------|-----------|-------------------------|
|   | $0 \pm 25 \pm 25$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(f_0(1370) \pi^0 \rightarrow \pi^+ \pi^- \pi^0)$ in $D^0, \bar{D}^0 \rightarrow f_0(1370) \pi^0$ | VALUE (%)           | DOCUMENT ID | TECN      | COMMENT                 |
|---|---------------------|-------------|-----------|-------------------------|
|   | $+25 \pm 13 \pm 13$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(f_0(1500) \pi^0 \rightarrow \pi^+ \pi^- \pi^0)$ in $D^0, \bar{D}^0 \rightarrow f_0(1500) \pi^0$ | VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                 |
|---|-------------------|-------------|-----------|-------------------------|
|   | $0 \pm 13 \pm 13$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(f_0(1710) \pi^0 \rightarrow \pi^+ \pi^- \pi^0)$ in $D^0, \bar{D}^0 \rightarrow f_0(1710) \pi^0$ | VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                 |
|---|-------------------|-------------|-----------|-------------------------|
|   | $0 \pm 17 \pm 17$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(f_2(1270) \pi^0 \rightarrow \pi^+ \pi^- \pi^0)$ in $D^0, \bar{D}^0 \rightarrow f_2(1270) \pi^0$ | VALUE (%)        | DOCUMENT ID | TECN      | COMMENT                 |
|---|------------------|-------------|-----------|-------------------------|
|   | $-4 \pm 4 \pm 4$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(\sigma(400) \pi^0 \rightarrow \pi^+ \pi^- \pi^0)$ in $D^0, \bar{D}^0 \rightarrow \sigma(400) \pi^0$ | VALUE (%)        | DOCUMENT ID | TECN      | COMMENT                 |
|---|------------------|-------------|-----------|-------------------------|
|   | $+6 \pm 6 \pm 6$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(\text{nonresonant } \pi^+ \pi^- \pi^0)$ in $D^0, \bar{D}^0 \rightarrow \text{nonresonant } \pi^+ \pi^- \pi^0$ | VALUE (%)           | DOCUMENT ID | TECN      | COMMENT                 |
|---|---------------------|-------------|-----------|-------------------------|
|   | $-13 \pm 19 \pm 13$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

| $A_{CP}(2\pi^+ 2\pi^-)$ in $D^0, \bar{D}^0 \rightarrow 2\pi^+ 2\pi^-$ | VALUE | DOCUMENT ID       | TECN      |
|---|-------|-------------------|-----------|
| no evidence   |       | <sup>1</sup> AAIJ | 13BR LHCB |

<sup>1</sup>AAIJ 13BR searched for  $CP$  violation in binned phase space. No evidence was found.

| $A_{CP}(K^+ K^- \pi^0)$ in $D^0, \bar{D}^0 \rightarrow K^+ K^- \pi^0$ | VALUE (%)                 | EVT5                  | DOCUMENT ID | TECN      | COMMENT                            |
|---|---------------------------|-----------------------|-------------|-----------|------------------------------------|
|   | $-1.00 \pm 1.67 \pm 0.25$ | $11 \pm 0.11\text{k}$ | AUBERT      | 08AO BABR | $e^+ e^- \approx 10.6 \text{ GeV}$ |

$A_{CP}(K^*(892)^+ K^- \rightarrow K^+ K^- \pi^0)$  in  $D^0 \rightarrow K^*(892)^+ K^-$ ,  $\bar{D}^0 \rightarrow$  c.c.

| VALUE (%)              | DOCUMENT ID         | TECN      | COMMENT                 |
|------------------------|---------------------|-----------|-------------------------|
| $-0.9 \pm 1.2 \pm 0.4$ | <sup>1</sup> AUBERT | 08AO BABR | Table 1, -Col.5/2×Col.2 |

<sup>1</sup> AUBERT 08AO report their result using a different sign convention.

$A_{CP}(K^*(1410)^+ K^- \rightarrow K^+ K^- \pi^0)$  in  $D^0 \rightarrow K^*(1410)^+ K^-$ ,  $\bar{D}^0 \rightarrow$  c.c.

| VALUE (%)          | DOCUMENT ID | TECN      | COMMENT                 |
|--------------------|-------------|-----------|-------------------------|
| $-21 \pm 23 \pm 8$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

$A_{CP}((K^+ \pi^0)_{S-wave} K^- \rightarrow K^+ K^- \pi^0)$  in  $D^0 \rightarrow (K^+ \pi^0)_S K^-$ ,  $\bar{D}^0 \rightarrow$  c.c.

| VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                 |
|-------------------|-------------|-----------|-------------------------|
| $+7 \pm 15 \pm 3$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

$A_{CP}(\phi(1020) \pi^0 \rightarrow K^+ K^- \pi^0)$  in  $D^0, \bar{D}^0 \rightarrow \phi(1020) \pi^0$

| VALUE (%)              | DOCUMENT ID | TECN      | COMMENT                 |
|------------------------|-------------|-----------|-------------------------|
| $+1.1 \pm 2.1 \pm 0.5$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

$A_{CP}(f_0(980) \pi^0 \rightarrow K^+ K^- \pi^0)$  in  $D^0, \bar{D}^0 \rightarrow f_0(980) \pi^0$

| VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                 |
|-------------------|-------------|-----------|-------------------------|
| $-3 \pm 19 \pm 1$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

$A_{CP}(a_0(980)^0 \pi^0 \rightarrow K^+ K^- \pi^0)$  in  $D^0, \bar{D}^0 \rightarrow a_0(980)^0 \pi^0$

| VALUE (%)         | DOCUMENT ID         | TECN      | COMMENT                 |
|-------------------|---------------------|-----------|-------------------------|
| $-5 \pm 16 \pm 2$ | <sup>1</sup> AUBERT | 08AO BABR | Table 1, -Col.5/2×Col.2 |

<sup>1</sup> This AUBERT 08AO value is obtained when the  $a_0(980)^0$  replaces the  $f_0(980)$  in the fit.

$A_{CP}(f'_2(1525) \pi^0 \rightarrow K^+ K^- \pi^0)$  in  $D^0, \bar{D}^0 \rightarrow f'_2(1525) \pi^0$

| VALUE (%)          | DOCUMENT ID | TECN      | COMMENT                 |
|--------------------|-------------|-----------|-------------------------|
| $0 \pm 50 \pm 150$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

$A_{CP}(K^*(892)^- K^+ \rightarrow K^+ K^- \pi^0)$  in  $D^0 \rightarrow K^*(892)^- K^+$ ,  $\bar{D}^0 \rightarrow$  c.c.

| VALUE (%)        | DOCUMENT ID | TECN      | COMMENT                 |
|------------------|-------------|-----------|-------------------------|
| $-5 \pm 4 \pm 1$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

$A_{CP}(K^*(1410)^- K^+ \rightarrow K^+ K^- \pi^0)$  in  $D^0 \rightarrow K^*(1410)^- K^+$ ,  $\bar{D}^0 \rightarrow$  c.c.

| VALUE (%)          | DOCUMENT ID | TECN      | COMMENT                 |
|--------------------|-------------|-----------|-------------------------|
| $-17 \pm 28 \pm 7$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |

$A_{CP}((K^- \pi^0)_{S-wave} K^+ \rightarrow K^+ K^- \pi^0)$  in  $D^0 \rightarrow (K^- \pi^0)_S K^+$ ,  $\bar{D}^0 \rightarrow$  c.c.

| VALUE (%)         | DOCUMENT ID | TECN      | COMMENT                 |
|-------------------|-------------|-----------|-------------------------|
| $-7 \pm 40 \pm 8$ | AUBERT      | 08AO BABR | Table 1, -Col.5/2×Col.2 |



### $A_{CP}(K_S^0 \pi^0)$ in $D^0, \bar{D}^0 \rightarrow K_S^0 \pi^0$

| VALUE (%)  | EVTS | DOCUMENT ID        | TECN | COMMENT                             |
|--|------|--------------------|------|-------------------------------------|
| <b>-0.20 ± 0.17 OUR AVERAGE</b>  |      |                    |      |                                     |
| -0.21 ± 0.16 ± 0.07  | 467k | <sup>1</sup> NISAR | 14   | BELL $e^+e^-$ at/near $\Upsilon$ 's |
| 0.1 ± 1.3  | 9099 | BONVICINI          | 01   | CLE2 $e^+e^- \approx 10.6$ GeV      |
| • • • We do not use the following data for averages, fits, limits, etc. • • •  |      |                    |      |                                     |
| -0.28 ± 0.19 ± 0.10  | 326k | KO                 | 11   | BELL See NISAR 14                   |
| -1.8 ± 3.0   |      | BARTELT            | 95   | CLE2 See BONVICINI 01               |
| <sup>1</sup> After subtracting CPV in $K^0 - \bar{K}^0$ mixing, NISAR 14 gets $A_{CP} = (+0.12 \pm 0.16 \pm 0.07)\%$ . |      |                    |      |                                     |

### $A_{CP}(K_S^0 \eta)$ in $D^0, \bar{D}^0 \rightarrow K_S^0 \eta$

| VALUE (%)                  | EVTS | DOCUMENT ID | TECN | COMMENT                            |
|----------------------------|------|-------------|------|------------------------------------|
| <b>+0.54 ± 0.51 ± 0.16</b> | 46k  | KO          | 11   | BELL $e^+e^- \approx \Upsilon(4S)$ |

### $A_{CP}(K_S^0 \eta')$ in $D^0, \bar{D}^0 \rightarrow K_S^0 \eta'$

| VALUE (%)                  | EVTS | DOCUMENT ID | TECN | COMMENT                            |
|----------------------------|------|-------------|------|------------------------------------|
| <b>+0.98 ± 0.67 ± 0.14</b> | 27k  | KO          | 11   | BELL $e^+e^- \approx \Upsilon(4S)$ |

### $A_{CP}(K_S^0 \phi)$ in $D^0, \bar{D}^0 \rightarrow K_S^0 \phi$

| VALUE (%)         | DOCUMENT ID | TECN | COMMENT                           |
|-------------------|-------------|------|-----------------------------------|
| <b>-2.8 ± 9.4</b> | BARTELT 95  | CLE2 | -18.2 < $A_{CP}$ < +12.6% (90%CL) |

### $A_{CP}(K^\mp \pi^\pm)$ in $D^0 \rightarrow K^- \pi^+, \bar{D}^0 \rightarrow K^+ \pi^-$

| VALUE (%)   | EVTS | DOCUMENT ID | TECN | COMMENT               |
|---|------|-------------|------|-----------------------|
| <b>0.3 ± 0.3 ± 0.6</b>  |      |             |      |                       |
|   |      | BONVICINI   | 14   | CLEO All CLEO-c runs  |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |      |             |      |                       |
| +0.5 ± 0.4 ± 0.9  | 150k | MENDEZ      | 10   | CLEO See BONVICINI 14 |
| -0.4 ± 0.5 ± 0.9  |      | DOBBS       | 07   | CLEO See BONVICINI 14 |

### $A_{CP}(K^\pm \pi^\mp)$ in $D^0 \rightarrow K^+ \pi^-, \bar{D}^0 \rightarrow K^- \pi^+$

| VALUE (%)                              | EVTS | DOCUMENT ID         | TECN | COMMENT                        |
|--|------|---------------------|------|--------------------------------|
| <b>0.0 ± 1.6 OUR AVERAGE</b>           |      |                     |      |                                |
| -0.7 ± 1.9                             |      | <sup>1</sup> AAIJ   | 13CE | LHCB $pp$ at 7, 8 TeV          |
| -2.1 ± 5.2 ± 1.5                       | 4.0k | AUBERT              | 07W  | BABR $e^+e^- \approx 10.6$ GeV |
| +2.3 ± 4.7                             | 4.0k | <sup>2</sup> ZHANG  | 06   | BELL $e^+e^-$                  |
| +18 ± 14 ± 4                           |      | <sup>3</sup> LINK   | 05H  | FOCS $\gamma$ nucleus          |
| +9.5 ± 6.1 ± 8.3                       |      | <sup>4</sup> AUBERT | 03Z  | BABR $e^+e^-$ , 10.6 GeV       |
| +2 <sup>+19</sup> / <sub>-20</sub> ± 1 | 45   | <sup>5</sup> GODANG | 00   | CLE2 $e^+e^-$                  |

- • • We do not use the following data for averages, fits, limits, etc. • • •
- 8.0 ± 7.7      0.8k      <sup>6</sup> LI      05A      BELL      See ZHANG 06
- <sup>1</sup> Based on 3 fb<sup>-1</sup> of data collected at  $\sqrt{s} = 7, 8$  TeV. Allowing for CP violation, the direct CP-violation in mixing is reported for the  $D^0 \rightarrow K^+ \pi^-$  and  $\bar{D}^0 \rightarrow K^+ \pi^-$ .
- <sup>2</sup> This ZHANG 06 result allows mixing.
- <sup>3</sup> This LINK 05H result assumes no mixing. If mixing is allowed, it becomes  $0.13^{+0.33}_{-0.25} \pm 0.10$ .
- <sup>4</sup> This AUBERT 03Z limit assumes no mixing. If mixing is allowed, the 95% confidence-level interval is  $(-2.8 < A_D < 4.9) \times 10^{-3}$ .

<sup>5</sup> This GODANG 00 result assumes no  $D^0$ - $\bar{D}^0$  mixing and becomes  $-0.43 < A_{CP} < +0.34$  at 95% CL. If mixing is allowed  $A_{CP} = -0.01^{+0.16}_{-0.17} \pm 0.01$ .

<sup>6</sup> This LI 05A result allows mixing.

### $A_{CP}(K^- \pi^+) \text{ in } D_{CP(\pm 1)} \rightarrow K^\mp \pi^\pm$

$$A_{CP}(K^- \pi^+) = [\text{B}(D_{CP(-)} \rightarrow K^- \pi^+ + \text{c.c.}) - \text{B}(D_{CP(+)} \rightarrow K^- \pi^+ + \text{c.c.})] / \text{Sum.}$$

| VALUE (%)               | DOCUMENT ID          | TECN | COMMENT   |
|-------------------------|----------------------|------|---|
| <b>12.7 ± 1.3 ± 0.7</b> | <sup>1</sup> ABLIKIM | 14C  | BES3 $e^+ e^- \rightarrow D^0 \bar{D}^0$ , 3.77 GeV |

<sup>1</sup> ABLIKIM 14C uses quantum correlations in  $e^+ e^- \rightarrow D^0 \bar{D}^0$  at the  $\psi(3770)$  to measure the asymmetry of the branching fraction of  $D^0 \rightarrow K^- \pi^+$  in  $CP$ -odd and  $CP$ -even eigenstates. It then extracts the strong-phase difference  $\delta_{K\pi}$ .

### $A_{CP}(K^\mp \pi^\pm \pi^0) \text{ in } D^0 \rightarrow K^- \pi^+ \pi^0, \bar{D}^0 \rightarrow K^+ \pi^- \pi^0$

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

#### **0.1 ± 0.5 OUR AVERAGE**

|                       |                   |    |                                 |
|-----------------------|-------------------|----|---------------------------------|
| $0.1 \pm 0.3 \pm 0.4$ | BONVICINI         | 14 | CLEO All CLEO-c runs            |
| $-3.1 \pm 8.6$        | <sup>1</sup> KOPP | 01 | CLE2 $e^+ e^- \approx 10.6$ GeV |

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

|                       |       |    |                       |
|-----------------------|-------|----|-----------------------|
| $0.2 \pm 0.4 \pm 0.8$ | DOBBS | 07 | CLEO See BONVICINI 14 |
|-----------------------|-------|----|-----------------------|

<sup>1</sup> KOPP 01 fits separately the  $D^0$  and  $\bar{D}^0$  Dalitz plots and then calculates the integrated difference of normalized densities divided by the integrated sum.

### $A_{CP}(K^\pm \pi^\mp \pi^0) \text{ in } D^0 \rightarrow K^+ \pi^- \pi^0, \bar{D}^0 \rightarrow K^- \pi^+ \pi^0$

| VALUE (%) | EVTS | DOCUMENT ID | TECN | COMMENT |
|-----------|------|-------------|------|---------|
|-----------|------|-------------|------|---------|

#### **0 ± 5 OUR AVERAGE**

|                  |                |             |    |                                     |
|------------------|----------------|-------------|----|-------------------------------------|
| $-0.6 \pm 5.3$   | $1978 \pm 104$ | TIAN        | 05 | BELL $e^+ e^- \approx \Upsilon(4S)$ |
| $+9^{+25}_{-22}$ | 38             | BRANDENB... | 01 | CLE2 $e^+ e^- \approx \Upsilon(4S)$ |

### $A_{CP}(K_S^0 \pi^+ \pi^-) \text{ in } D^0, \bar{D}^0 \rightarrow K_S^0 \pi^+ \pi^-$

| VALUE (%) | EVTS | DOCUMENT ID | TECN | COMMENT |
|-----------|------|-------------|------|---------|
|-----------|------|-------------|------|---------|

#### **-0.1 ± 0.8 OUR AVERAGE**

|                              |      |                       |      |                               |
|------------------------------|------|-----------------------|------|-------------------------------|
| $-0.05 \pm 0.57 \pm 0.54$    | 350k | <sup>1</sup> AALTONEN | 12AD | CDF                           |
| $-0.9 \pm 2.1^{+1.6}_{-5.7}$ | 4854 | <sup>2</sup> ASNER    | 04A  | CLEO $e^+ e^- \approx 10$ GeV |

<sup>1</sup> This is the overall result of AALTONEN 12AD. Following are the 15  $CP$  fit-fraction asymmetries from the amplitude analysis of the  $D^0$  and  $\bar{D}^0 \rightarrow K_S^0 \pi^+ \pi^-$  Dalitz plots.

<sup>2</sup> This is the overall result of ASNER 04A;  $CP$ -violating limits are also given below for each of the 10 resonant submodes found in an amplitude analysis of the  $D^0$  and  $\bar{D}^0 \rightarrow K_S^0 \pi^+ \pi^-$  Dalitz plots.

### $A_{CP}(K^*(892)^\mp \pi^\pm \rightarrow K_S^0 \pi^+ \pi^-) \text{ in } D^0 \rightarrow K^{*-} \pi^+, \bar{D}^0 \rightarrow K^{*+} \pi^-$

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

**+0.36 ± 0.33 ± 0.40** AALTONEN 12AD CDF Dalitz fit,  $\sim 350$ k evts

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

|                              |       |     |                            |
|------------------------------|-------|-----|----------------------------|
| $+2.5 \pm 1.9^{+3.3}_{-0.8}$ | ASNER | 04A | CLEO Dalitz fit, 4854 evts |
|------------------------------|-------|-----|----------------------------|

**$A_{CP}(K^*(892)^\pm \pi^\mp \rightarrow K_S^0 \pi^+ \pi^-)$  in  $D^0 \rightarrow K^{*+} \pi^-, \bar{D}^0 \rightarrow K^{*-} \pi^+$**

This is a doubly Cabibbo-suppressed mode.

| VALUE (%)   | DOCUMENT ID | TECN     | COMMENT                       |
|---|-------------|----------|-------------------------------|
| $+1.0 \pm 5.7 \pm 2.1$  | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350$ k evts |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |          |                               |
| $-21 \pm 42 \pm 28$   | ASNER       | 04A CLEO | Dalitz fit, 4854 evts         |

**$A_{CP}(K_S^0 \rho^0 \rightarrow K_S^0 \pi^+ \pi^-)$  in  $D^0 \rightarrow \bar{K}^0 \rho^0, \bar{D}^0 \rightarrow K^0 \rho^0$**

| VALUE (%)   | DOCUMENT ID | TECN     | COMMENT                       |
|---|-------------|----------|-------------------------------|
| $-0.05 \pm 0.50 \pm 0.08$   | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350$ k evts |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |          |                               |
| $+3.1 \pm 3.8 \begin{smallmatrix} +2.7 \\ -2.2 \end{smallmatrix}$             | ASNER       | 04A CLEO | Dalitz fit, 4854 evts         |

**$A_{CP}(K_S^0 \omega \rightarrow K_S^0 \pi^+ \pi^-)$  in  $D^0 \rightarrow \bar{K}^0 \omega, \bar{D}^0 \rightarrow K^0 \omega$**

| VALUE (%)   | DOCUMENT ID | TECN     | COMMENT                       |
|---|-------------|----------|-------------------------------|
| $-12.6 \pm 6.0 \pm 2.6$   | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350$ k evts |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |          |                               |
| $-26 \pm 24 \begin{smallmatrix} +22 \\ -4 \end{smallmatrix}$                  | ASNER       | 04A CLEO | Dalitz fit, 4854 evts         |

**$A_{CP}(K_S^0 f_0(980) \rightarrow K_S^0 \pi^+ \pi^-)$  in  $D^0 \rightarrow \bar{K}^0 f_0(980), \bar{D}^0 \rightarrow K^0 f_0(980)$**

| VALUE (%)   | DOCUMENT ID | TECN     | COMMENT                       |
|---|-------------|----------|-------------------------------|
| $-0.4 \pm 2.2 \pm 1.6$  | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350$ k evts |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |          |                               |
| $-4.7 \pm 11.0 \begin{smallmatrix} +24.9 \\ -8.8 \end{smallmatrix}$           | ASNER       | 04A CLEO | Dalitz fit, 4854 evts         |

**$A_{CP}(K_S^0 f_2(1270) \rightarrow K_S^0 \pi^+ \pi^-)$  in  $D^0 \rightarrow \bar{K}^0 f_2(1270), \bar{D}^0 \rightarrow K^0 f_2(1270)$**

| VALUE (%)   | DOCUMENT ID | TECN     | COMMENT                       |
|---|-------------|----------|-------------------------------|
| $-4.0 \pm 3.4 \pm 3.0$  | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350$ k evts |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |          |                               |
| $+34 \pm 51 \begin{smallmatrix} +33 \\ -79 \end{smallmatrix}$                 | ASNER       | 04A CLEO | Dalitz fit, 4854 evts         |

**$A_{CP}(K_S^0 f_0(1370) \rightarrow K_S^0 \pi^+ \pi^-)$  in  $D^0 \rightarrow \bar{K}^0 f_0(1370), \bar{D}^0 \rightarrow K^0 f_0(1370)$**

| VALUE (%)   | DOCUMENT ID | TECN     | COMMENT                       |
|---|-------------|----------|-------------------------------|
| $-0.5 \pm 4.6 \pm 7.7$  | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350$ k evts |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |             |          |                               |
| $+18 \pm 10 \begin{smallmatrix} +13 \\ -22 \end{smallmatrix}$                 | ASNER       | 04A CLEO | Dalitz fit, 4854 evts         |

**$A_{CP}(K_S^0 \rho^0(1450))$  in  $D^0 \rightarrow \bar{K}^0 \rho^0(1450), \bar{D}^0 \rightarrow K^0 \rho^0(1450)$**

| VALUE (%)              | DOCUMENT ID | TECN     | COMMENT                       |
|------------------------|-------------|----------|-------------------------------|
| $-4.1 \pm 5.2 \pm 8.1$ | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350$ k evts |

**$A_{CP}(K_S^0 f_0(600))$  in  $D^0 \rightarrow \bar{K}^0 f_0(600), \bar{D}^0 \rightarrow K^0 f_0(600)$**

| VALUE (%)              | DOCUMENT ID | TECN     | COMMENT                       |
|------------------------|-------------|----------|-------------------------------|
| $-2.7 \pm 2.7 \pm 3.6$ | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350$ k evts |

| $A_{CP}(K^*(1410)^\mp \pi^\pm)$ in $D^0 \rightarrow K^*(1410)^- \pi^+, \bar{D}^0 \rightarrow K^*(1410)^+ \pi^-$ | VALUE (%)              | DOCUMENT ID | TECN     | COMMENT                      |
|---|------------------------|-------------|----------|------------------------------|
|   | $-2.3 \pm 5.7 \pm 6.4$ | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350k$ evts |

| $A_{CP}(K_0^*(1430)^\mp \pi^\pm) \rightarrow K_S^0 \pi^+ \pi^-$ in $D^0 \rightarrow K_0^*(1430)^- \pi^+, \bar{D}^0 \rightarrow \text{c.c.}$ | VALUE (%)             | DOCUMENT ID | TECN     | COMMENT                      |
|---|-----------------------|-------------|----------|------------------------------|
|   | $4.0 \pm 2.4 \pm 3.8$ | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350k$ evts |

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

|                               |       |          |                       |
|-------------------------------|-------|----------|-----------------------|
| $-0.2 \pm 11.3^{+8.8}_{-5.0}$ | ASNER | 04A CLEO | Dalitz fit, 4854 evts |
|-------------------------------|-------|----------|-----------------------|

| $A_{CP}(K_0^*(1430)^\pm \pi^\mp)$ in $D^0 \rightarrow K_0^*(1430)^+ \pi^-, \bar{D}^0 \rightarrow K_0^*(1430)^- \pi^+$<br>This is a doubly Cabibbo-suppressed mode. | VALUE (%)           | DOCUMENT ID | TECN     | COMMENT                      |
|--|---------------------|-------------|----------|------------------------------|
|  | $+12 \pm 11 \pm 10$ | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350k$ evts |

| $A_{CP}(K_2^*(1430)^\mp \pi^\pm) \rightarrow K_S^0 \pi^+ \pi^-$ in $D^0 \rightarrow K_2^*(1430)^- \pi^+, \bar{D}^0 \rightarrow \text{c.c.}$ | VALUE (%)              | DOCUMENT ID | TECN     | COMMENT                      |
|---|------------------------|-------------|----------|------------------------------|
|   | $+2.9 \pm 4.0 \pm 4.1$ | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350k$ evts |

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

|                         |       |          |                       |
|-------------------------|-------|----------|-----------------------|
| $-7 \pm 25^{+13}_{-26}$ | ASNER | 04A CLEO | Dalitz fit, 4854 evts |
|-------------------------|-------|----------|-----------------------|

| $A_{CP}(K_2^*(1430)^\pm \pi^\mp)$ in $D^0 \rightarrow K_2^*(1430)^+ \pi^-, \bar{D}^0 \rightarrow K_2^*(1430)^- \pi^+$<br>This is a doubly Cabibbo-suppressed mode. | VALUE (%)           | DOCUMENT ID | TECN     | COMMENT                      |
|--|---------------------|-------------|----------|------------------------------|
|  | $-10 \pm 14 \pm 29$ | AALTONEN    | 12AD CDF | Dalitz fit, $\sim 350k$ evts |

| $A_{CP}(K^*(1680)^\mp \pi^\pm) \rightarrow K_S^0 \pi^+ \pi^-$ in $D^0 \rightarrow K^*(1680)^- \pi^+, \bar{D}^0 \rightarrow \text{c.c.}$ | VALUE (%)                | DOCUMENT ID | TECN     | COMMENT               |
|---|--------------------------|-------------|----------|-----------------------|
|   | $-36 \pm 19^{+10}_{-35}$ | ASNER       | 04A CLEO | Dalitz fit, 4854 evts |

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

| $A_{CP}(K^- \pi^+ \pi^+ \pi^-)$ in $D^0 \rightarrow K^- \pi^+ \pi^+ \pi^-, \bar{D}^0 \rightarrow K^+ \pi^- \pi^- \pi^+$ | VALUE (%)             | DOCUMENT ID | TECN    | COMMENT         |
|---|-----------------------|-------------|---------|-----------------|
|   | $0.2 \pm 0.3 \pm 0.4$ | BONVICINI   | 14 CLEO | All CLEO-c runs |

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

|                        |       |         |                  |
|------------------------|-------|---------|------------------|
| $+0.7 \pm 0.5 \pm 0.9$ | DOBBS | 07 CLEO | See BONVICINI 14 |
|------------------------|-------|---------|------------------|

| $A_{CP}(K^\pm \pi^\mp \pi^+ \pi^-)$ in $D^0 \rightarrow K^+ \pi^- \pi^+ \pi^-, \bar{D}^0 \rightarrow K^- \pi^+ \pi^+ \pi^-$ | VALUE (%)      | EVTS          | DOCUMENT ID | TECN    | COMMENT                        |
|---|----------------|---------------|-------------|---------|--------------------------------|
|   | $-1.8 \pm 4.4$ | $1721 \pm 75$ | TIAN        | 05 BELL | $e^+ e^- \approx \Upsilon(4S)$ |

| $A_{CP}(K^+ K^- \pi^+ \pi^-)$ in $D^0, \bar{D}^0 \rightarrow K^+ K^- \pi^+ \pi^-$<br>See also AAIJ 13BR for a search for $CP$ violation in $D^0 \rightarrow K^+ K^- \pi^+ \pi^-$ in binned phase space. No evidence of $CP$ violation was found. | VALUE (%)              | EVTS         | DOCUMENT ID | TECN     | COMMENT  |
|--|------------------------|--------------|-------------|----------|--|
|  | $-8.2 \pm 5.6 \pm 4.7$ | $828 \pm 46$ | LINK        | 05E FOCS | $\gamma A, \bar{E}_\gamma \approx 180 \text{ GeV}$ |

|  |                    |             |                |                           |
|--|--------------------|-------------|----------------|---------------------------|
| $A_{CP}(K_1^*(1270)^+ K^- \rightarrow K^{*0} \pi^+ K^-)$ in $D^0 \rightarrow K_1^*(1270)^+ K^-, \bar{D}^0 \rightarrow$ c.c.  |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $-0.7 \pm 10.4$  | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}(K_1^*(1270)^- K^+ \rightarrow \bar{K}^{*0} \pi^- K^+)$ in $D^0 \rightarrow K_1^*(1270)^- K^+, \bar{D}^0 \rightarrow$ c.c.                                  |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $-10.0 \pm 31.5$   | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}(K_1^*(1270)^+ K^- \rightarrow \rho^0 K^+ K^-)$ in $D^0 \rightarrow K_1^*(1270)^+ K^-, \bar{D}^0 \rightarrow$ c.c.  |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $-6.5 \pm 16.9$  | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}(K_1^*(1270)^- K^+ \rightarrow \rho^0 K^- K^+)$ in $D^0 \rightarrow K_1^*(1270)^- K^+, \bar{D}^0 \rightarrow$ c.c.  |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $+9.6 \pm 12.9$  | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}(K^*(1410)^+ K^- \rightarrow K^{*0} \pi^+ K^-)$ in $D^0 \rightarrow K^*(1410)^+ K^-, \bar{D}^0 \rightarrow$ c.c.  |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $-20.0 \pm 16.8$   | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}(K^*(1410)^- K^+ \rightarrow \bar{K}^{*0} \pi^- K^+)$ in $D^0 \rightarrow K^*(1410)^- K^+, \bar{D}^0 \rightarrow$ c.c.                                      |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $-1.1 \pm 13.7$  | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}(K^{*0} \bar{K}^{*0} S\text{-wave})$ in $D^0, \bar{D}^0 \rightarrow K^{*0} \bar{K}^{*0} S\text{-wave}$  |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $+9.5 \pm 13.5$  | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}(\phi \rho^0 S\text{-wave})$ in $D^0, \bar{D}^0 \rightarrow \phi \rho^0 S\text{-wave}$  |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $-2.7 \pm 5.3$   | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}(\phi \rho^0 D\text{-wave})$ in $D^0, \bar{D}^0 \rightarrow \phi \rho^0 D\text{-wave}$  |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $-37.1 \pm 19.0$   | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}(\phi(\pi^+ \pi^-) S\text{-wave})$ in $D^0, \bar{D}^0 \rightarrow \phi(\pi^+ \pi^-) S\text{-wave}$  |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $-8.6 \pm 10.4$  | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |
| $A_{CP}((K^- \pi^+) P\text{-wave} (K^+ \pi^-) S\text{-wave})$ in $D^0 \rightarrow (K^- \pi^+) P\text{-wave} (K^+ \pi^-) S\text{-wave}, \bar{D}^0 \rightarrow$ c.c. |                    |             |                |                           |
| <u>VALUE (%)</u>   | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |                           |
| $+2.7 \pm 10.6$  | ARTUSO             | 12          | CLEO           | Amplitude fit, 2959 evts. |

## $D^0$ CP-VIOLATING ASYMMETRY DIFFERENCES

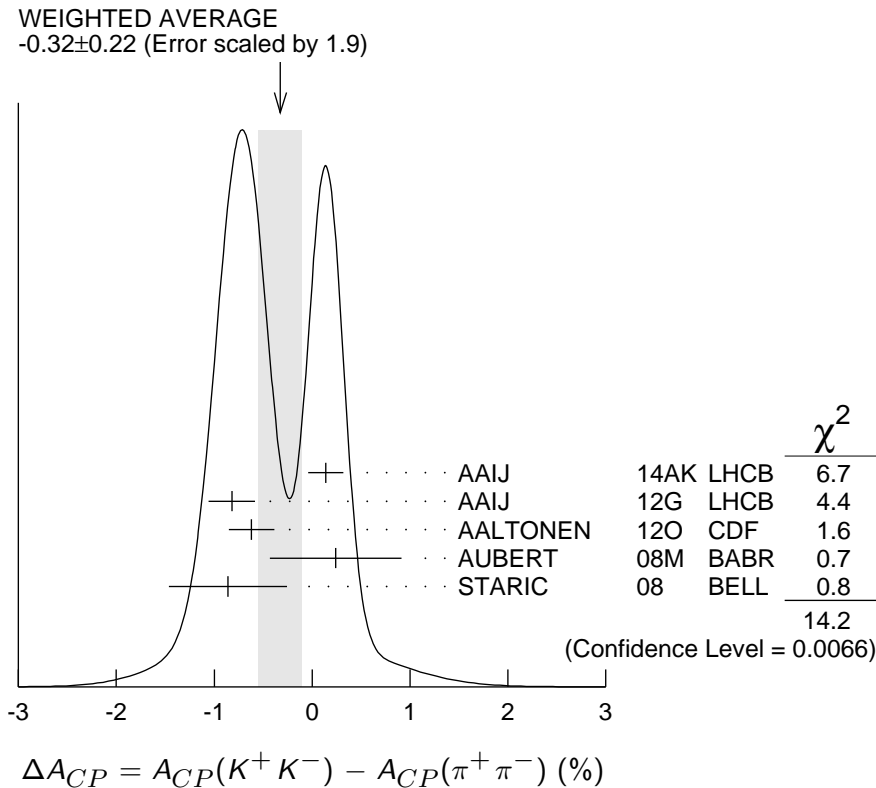
$$\Delta A_{CP} = A_{CP}(K^+ K^-) - A_{CP}(\pi^+ \pi^-)$$

CP violation in these modes can come from the decay amplitudes (direct) and/or from mixing or interference of mixing and decay (indirect). The difference  $\Delta A_{CP}$  is primarily sensitive to the direct component, and only retains a second-order dependence on the indirect component for measurements where the mean decay time of the  $K^+ K^-$  and  $\pi^+ \pi^-$  samples are not identical. The results below are averaged assuming the indirect component can be neglected.

| VALUE (%)   | EVTS       | DOCUMENT ID           | TECN      | COMMENT          |
|---|------------|-----------------------|-----------|------------------|
| <b>-0.32±0.22 OUR AVERAGE</b> Error includes scale factor of 1.9. See the ideogram below. |            |                       |           |                  |
| 0.14±0.16±0.08  | 2.17/0.77M | <sup>1</sup> AAIJ     | 14AK LHCb | Time-integrated  |
| -0.82±0.21±0.11   |            | <sup>1</sup> AAIJ     | 12G LHCb  | Time-integrated  |
| -0.62±0.21±0.10   |            | <sup>1</sup> AALTONEN | 12O CDF   | Time-integrated  |
| 0.24±0.62±0.26  |            | <sup>1,2</sup> AUBERT | 08M BABR  | Time-integrated  |
| -0.86±0.60±0.07   | 120k       | <sup>1</sup> STARIC   | 08 BELL   | Time-integrated  |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●             |            |                       |           |                  |
| 0.49±0.30±0.14  | 559/222k   | AAIJ                  | 13AD LHCb | See AAIJ 14AK    |
| -0.46±0.31±0.12   |            | AALTONEN              | 12B CDF   | See AALTONEN 12O |

<sup>1</sup> D's from D\*'s decays.

<sup>2</sup> Calculated from the AUBERT 08M values of  $A_{CP}(K^+ K^-)$  and  $A_{CP}(\pi^+ \pi^-)$ . The systematic error here combines the systematic errors in quadrature, and therefore somewhat over-estimates it.



## $D^0 \chi^2$ TESTS OF $CP$ -VIOLATION ( $CPV$ )

We list model-independent searches for local  $CP$  violation in phase-space distributions of multi-body decays.

Most of these searches divide phase space (Dalitz plot for 3-body decays, five-dimensional equivalent for 4-body decays) into bins, and perform a  $\chi^2$  test comparing normalised yields  $N_i, \bar{N}_i$  in  $CP$ -conjugate bin pairs  $i$ :  $\chi^2 = \sum_i (N_i - \alpha \bar{N}_i) / \sigma(N_i - \alpha \bar{N}_i)$ . The factor  $\alpha = (\sum_i N_i) / (\sum_i \bar{N}_i)$  removes the dependence on phase-space-integrated rate asymmetries. The result is used to obtain the probability (p-value) to obtain the measured  $\chi^2$  or larger under the assumption of  $CP$  conservation [AUBERT 08AO, BEDIAGA 09]. Alternative methods obtain p-values from other test variables based on unbinned analyses [WILLIAMS 11, AAIJ 14C]. Results can be combined using Fisher's method [MOSTELLER 48].

### Local $CPV$ in $D^0, \bar{D}^0 \rightarrow \pi^+ \pi^- \pi^0$

| <u>p-value (%)</u>        | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>  |
|---------------------------|-------------|--------------------|-------------|-----------------|
| <b>4.9 OUR EVALUATION</b> |             |                    |             |                 |
| 2.6                       | 566k        | <sup>1</sup> AAIJ  | 15A LHCb    | unbinned method |
| 32.8                      | 82k         | AUBERT             | 08AO BABR   | $\chi^2$        |

<sup>1</sup> Unusually, AAIJ 15A assigns an uncertainty on the p value of  $\pm 0.5\%$ . This results from limited test statistics.

### Local $CPV$ in $D^0, \bar{D}^0 \rightarrow \pi^+ \pi^- \pi^+ \pi^-$

| <u>p-value (%)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------------|-------------|--------------------|-------------|----------------|
| <b>41</b>          | 330k        | AAIJ               | 13BR LHCb   | $\chi^2$       |

### Local $CPV$ in $D^0, \bar{D}^0 \rightarrow K_S^0 \pi^+ \pi^-$

| <u>p-value (%)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------------|-------------|--------------------|-------------|----------------|
| <b>96</b>          | 350k        | AALTONEN           | 12AD CDF    | $\chi^2$       |

### Local $CPV$ in $D^0, \bar{D}^0 \rightarrow K^+ K^- \pi^0$

| <u>p-value (%)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------------|-------------|--------------------|-------------|----------------|
| <b>16.6</b>        | 11k         | AUBERT             | 08AO BABR   | $\chi^2$       |

### Local $CPV$ in $D^0, \bar{D}^0 \rightarrow K^+ K^- \pi^+ \pi^-$

| <u>p-value (%)</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------------|-------------|--------------------|-------------|----------------|
| <b>9.1</b>         | 57k         | AAIJ               | 13BR LHCb   | $\chi^2$       |

## $CP$ VIOLATING ASYMMETRIES OF $P$ -ODD ( $T$ -ODD) MOMENTS

The  $CP$ -sensitive  $P$ -odd ( $T$ -odd) correlation in  $D^0, \bar{D}^0 \rightarrow K^+ K^- \pi^+ \pi^-$  decays.  $D^0$  and  $\bar{D}^0$  are distinguished by the charge of the parent  $D^*$ :  $D^{*+} \rightarrow D^0 \pi^+$  and  $D^{*-} \rightarrow \bar{D}^0 \pi^-$ .

### $A_{Tviol}(K^+ K^- \pi^+ \pi^-)$ in $D^0, \bar{D}^0 \rightarrow K^+ K^- \pi^+ \pi^-$

$C_T \equiv \vec{p}_{K^+} \cdot (\vec{p}_{\pi^+} \times \vec{p}_{\pi^-})$  is a parity-odd correlation of the  $K^+$ ,  $\pi^+$ , and  $\pi^-$  momenta (evaluated in the  $D^0$  rest frame) for the  $D^0$ .  $\bar{C}_T \equiv \vec{p}_{K^-} \cdot (\vec{p}_{\pi^-} \times \vec{p}_{\pi^+})$  is the corresponding quantity for the  $\bar{D}^0$ . Then

$A_T \equiv [\Gamma(C_T > 0) - \Gamma(C_T < 0)] / [\Gamma(C_T > 0) + \Gamma(C_T < 0)]$ , and  
 $\bar{A}_T \equiv [\Gamma(-\bar{C}_T > 0) - \Gamma(-\bar{C}_T < 0)] / [\Gamma(-\bar{C}_T > 0) + \Gamma(-\bar{C}_T < 0)]$ , and  
 $A_{Tviol} \equiv \frac{1}{2}(A_T - \bar{A}_T)$ .  $C_T$  and  $\bar{C}_T$  are commonly referred to as  $T$ -odd moments, because they are odd under  $T$  reversal. However, the  $T$ -conjugate process  $K^+ K^- \pi^+ \pi^- \rightarrow D^0$  is not accessible, while the  $P$ -conjugate process is.

| VALUE (units $10^{-3}$ )  | EVTS | DOCUMENT ID    | TECN      | COMMENT                                    |
|---|------|----------------|-----------|--|
| <b>1.7 ± 2.7 OUR AVERAGE</b>  |      |                |           |  |
| 1.8 ± 2.9 ± 0.4   | 171k | AAIJ           | 14BC LHCb | $B \rightarrow D^0 \mu^- X$                |
| 1.0 ± 5.1 ± 4.4   | 47k  | DEL-AMO-SA..10 | BABR      | $e^+ e^- \approx 10.6$ GeV                 |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |      |                |           |  |
| 10 ± 57 ± 37  | 0.8k | LINK           | 05E FOCS  | $\gamma A, \bar{E}_\gamma \approx 180$ GeV |

### $D^0$ CPT-VIOLATING DECAY-RATE ASYMMETRIES

#### $A_{CPT}(K^\mp \pi^\pm)$ in $D^0 \rightarrow K^- \pi^+, \bar{D}^0 \rightarrow K^+ \pi^-$

$A_{CPT}(t)$  is defined in terms of the time-dependent decay probabilities  $P(D^0 \rightarrow K^- \pi^+)$  and  $\bar{P}(\bar{D}^0 \rightarrow K^+ \pi^-)$  by  $A_{CPT}(t) = (\bar{P} - P)/(\bar{P} + P)$ . For small mixing parameters  $x \equiv \Delta m/\Gamma$  and  $y \equiv \Delta\Gamma/2\Gamma$  (as is the case), and times  $t$ ,  $A_{CPT}(t)$  reduces to  $[y \operatorname{Re} \xi - x \operatorname{Im} \xi] \Gamma t$ , where  $\xi$  is the CPT-violating parameter.

The following is actually  $y \operatorname{Re} \xi - x \operatorname{Im} \xi$ .

| VALUE                           | DOCUMENT ID | TECN     | COMMENT  |
|---------------------------------|-------------|----------|--|
| <b>0.0083 ± 0.0065 ± 0.0041</b> | LINK        | 03B FOCS | $\gamma$ nucleus, $\bar{E}_\gamma \approx 180$ GeV |

### $D^0 \rightarrow K^*(892)^- \ell^+ \nu_\ell$ FORM FACTORS

#### $r_V \equiv V(0)/A_1(0)$ in $D^0 \rightarrow K^*(892)^- \ell^+ \nu_\ell$

| VALUE                     | DOCUMENT ID | TECN     | COMMENT                    |
|---------------------------|-------------|----------|----------------------------|
| <b>1.71 ± 0.68 ± 0.34</b> | LINK        | 05B FOCS | $K^*(892)^- \mu^+ \nu_\mu$ |

#### $r_2 \equiv A_2(0)/A_1(0)$ in $D^0 \rightarrow K^*(892)^- \ell^+ \nu_\ell$

| VALUE                     | DOCUMENT ID | TECN     | COMMENT                    |
|---------------------------|-------------|----------|----------------------------|
| <b>0.91 ± 0.37 ± 0.10</b> | LINK        | 05B FOCS | $K^*(892)^- \mu^+ \nu_\mu$ |

### $D^0 \rightarrow K^- / \pi^- \ell^+ \nu_\ell$ FORM FACTORS

#### $f_+(0)$ in $D^0 \rightarrow K^- \ell^+ \nu_\ell$

| VALUE                        | DOCUMENT ID | TECN      | COMMENT                         |
|------------------------------|-------------|-----------|---------------------------------|
| <b>0.727 ± 0.007 ± 0.009</b> | AUBERT      | 07BG BABR | $K^- e^+ \nu_e$ 2-parameter fit |

#### $f_+(0)|V_{cs}|$ in $D^0 \rightarrow K^- \ell^+ \nu_\ell$

| VALUE                        | DOCUMENT ID | TECN    | COMMENT                         |
|------------------------------|-------------|---------|---------------------------------|
| <b>0.726 ± 0.008 ± 0.004</b> | BESSON      | 09 CLEO | $K^- e^+ \nu_e$ 3-parameter fit |

#### $r_1 \equiv a_1/a_0$ in $D^0 \rightarrow K^- \ell^+ \nu_\ell$

| VALUE                      | DOCUMENT ID | TECN    | COMMENT                         |
|----------------------------|-------------|---------|---------------------------------|
| <b>-2.65 ± 0.34 ± 0.08</b> | BESSON      | 09 CLEO | $K^- e^+ \nu_e$ 3-parameter fit |



$$r_2 \equiv a_1/a_0 \text{ in } D^0 \rightarrow K^- \ell^+ \nu_\ell$$

| VALUE         | DOCUMENT ID | TECN | COMMENT                              |
|---------------|-------------|------|--------------------------------------|
| <b>13±9±1</b> | BESSON      | 09   | CLEO $K^- e^+ \nu_e$ 3-parameter fit |

$$f_+(0)|V_{cd}| \text{ in } D^0 \rightarrow \pi^- \ell^+ \nu_\ell$$

| VALUE                    | DOCUMENT ID | TECN | COMMENT                                |
|--------------------------|-------------|------|--|
| <b>0.152±0.005±0.001</b> | BESSON      | 09   | CLEO $\pi^- e^+ \nu_e$ 3-parameter fit |

$$r_1 \equiv a_1/a_0 \text{ in } D^0 \rightarrow \pi^- \ell^+ \nu_\ell$$

| VALUE                  | DOCUMENT ID | TECN | COMMENT                                |
|------------------------|-------------|------|--|
| <b>-2.80±0.49±0.04</b> | BESSON      | 09   | CLEO $\pi^- e^+ \nu_e$ 3-parameter fit |

$$r_2 \equiv a_1/a_0 \text{ in } D^0 \rightarrow \pi^- \ell^+ \nu_\ell$$

| VALUE        | DOCUMENT ID | TECN | COMMENT                                |
|--------------|-------------|------|--|
| <b>6±3±0</b> | BESSON      | 09   | CLEO $\pi^- e^+ \nu_e$ 3-parameter fit |

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|                |      |                        |                                  |                       |
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| RUBIN          | 06   | PRL 96 081802          | P. Rubin <i>et al.</i>           | (CLEO Collab.)        |
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| ZHANG          | 06   | PRL 96 151801          | L.M. Zhang <i>et al.</i>         | (BELLE Collab.)       |
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| ASNER          | 05   | PR D72 012001          | D.M. Asner <i>et al.</i>         | (CLEO Collab.)        |
| AUBERT,B       | 05J  | PR D72 052008          | B. Aubert <i>et al.</i>          | (BABAR Collab.)       |
| BITENC         | 05   | PR D72 071101          | U. Bitenc <i>et al.</i>          | (BELLE Collab.)       |
| CAWLFIELD      | 05   | PR D71 077101          | C. Cawfield <i>et al.</i>        | (CLEO Collab.)        |
| COAN           | 05   | PRL 95 181802          | T.E. Coan <i>et al.</i>          | (CLEO Collab.)        |
| CRONIN-HEN...  | 05   | PR D72 031102          | D. Cronin-Hennessy <i>et al.</i> | (CLEO Collab.)        |
| HE             | 05   | PRL 95 121801          | Q. He <i>et al.</i>              | (CLEO Collab.)        |
| Also           |      | PRL 96 199903 (errat.) | Q. He <i>et al.</i>              | (CLEO Collab.)        |
| HUANG          | 05   | PRL 94 011802          | G.S. Huang <i>et al.</i>         | (CLEO Collab.)        |
| KAYIS-TOPAK... | 05   | PL B626 24             | A. Kayis-Topaksu <i>et al.</i>   | (CERN CHORUS Collab.) |
| LI             | 05A  | PRL 94 071801          | J. Li <i>et al.</i>              | (BELLE Collab.)       |
| LINK           | 05   | PL B607 51             | J.M. Link <i>et al.</i>          | (FNAL FOCUS Collab.)  |
| LINK           | 05A  | PL B607 59             | J.M. Link <i>et al.</i>          | (FNAL FOCUS Collab.)  |
| LINK           | 05B  | PL B607 67             | J.M. Link <i>et al.</i>          | (FNAL FOCUS Collab.)  |

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| LINK        | 05E | PL B622 239            | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| LINK        | 05G | PL B610 225            | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| LINK        | 05H | PL B618 23             | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| ONENGUT     | 05  | PL B613 105            | G. Onengut <i>et al.</i>     | (CERN CHORUS Collab.)   |
| TIAN        | 05  | PRL 95 231801          | X.C. Tian <i>et al.</i>      | (BELLE Collab.)         |
| ABLIKIM     | 04C | PL B597 39             | M. Ablikim <i>et al.</i>     | (BEPC BES Collab.)      |
| ABT         | 04  | PL B596 173            | I. Abt <i>et al.</i>         | (HERA B Collab.)        |
| ASNER       | 04A | PR D70 091101          | D.M. Asner <i>et al.</i>     | (CLEO Collab.)          |
| AUBERT      | 04Q | PR D69 051101          | B. Aubert <i>et al.</i>      | (BABAR Collab.)         |
| AUBERT,B    | 04Q | PR D70 091102          | B. Aubert <i>et al.</i>      | (BABAR Collab.)         |
| AUBERT,B    | 04Y | PRL 93 191801          | B. Aubert <i>et al.</i>      | (BABAR Collab.)         |
| LINK        | 04B | PL B586 21             | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| LINK        | 04D | PL B586 191            | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| RUBIN       | 04  | PRL 93 111801          | P. Rubin <i>et al.</i>       | (CLEO Collab.)          |
| TAJIMA      | 04  | PRL 92 101803          | O. Tajima <i>et al.</i>      | (BELLE Collab.)         |
| ACOSTA      | 03F | PR D68 091101          | D. Acosta <i>et al.</i>      | (CDF Collab.)           |
| AUBERT      | 03P | PRL 91 121801          | B. Aubert <i>et al.</i>      | (BABAR Collab.)         |
| AUBERT      | 03Z | PRL 91 171801          | B. Aubert <i>et al.</i>      | (BABAR Collab.)         |
| COAN        | 03  | PRL 90 101801          | T.E. Coan <i>et al.</i>      | (CLEO Collab.)          |
| LINK        | 03  | PL B555 167            | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| LINK        | 03B | PL B556 7              | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| LINK        | 03G | PL B575 190            | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| ABE         | 02I | PRL 88 162001          | K. Abe <i>et al.</i>         | (KEK BELLE Collab.)     |
| CSORNA      | 02  | PR D65 092001          | S.E. Csorna <i>et al.</i>    | (CLEO Collab.)          |
| LINK        | 02F | PL B537 192            | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| MURAMATSU   | 02  | PRL 89 251802          | H. Muramatsu <i>et al.</i>   | (CLEO Collab.)          |
| Also        |     | PRL 90 059901 (errata) | H. Muramatsu <i>et al.</i>   | (CLEO Collab.)          |
| AITALA      | 01C | PRL 86 3969            | E.M. Aitala <i>et al.</i>    | (FNAL E791 Collab.)     |
| AITALA      | 01D | PR D64 112003          | E.M. Aitala <i>et al.</i>    | (FNAL E791 Collab.)     |
| BONVICINI   | 01  | PR D63 071101          | G. Bonvicini <i>et al.</i>   | (CLEO Collab.)          |
| BRANDENB... | 01  | PRL 87 071802          | G. Brandenburg <i>et al.</i> | (CLEO Collab.)          |
| DYTMAN      | 01  | PR D64 111101          | S.A. Dytman <i>et al.</i>    | (CLEO Collab.)          |
| KOPP        | 01  | PR D63 092001          | S. Kopp <i>et al.</i>        | (CLEO Collab.)          |
| KUSHNIR...  | 01  | PRL 86 5243            | A. Kushnirenko <i>et al.</i> | (FNAL SELEX Collab.)    |
| LINK        | 01  | PRL 86 2955            | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| BAI         | 00C | PR D62 052001          | J.Z. Bai <i>et al.</i>       | (BEPC BES Collab.)      |
| GODANG      | 00  | PRL 84 5038            | R. Godang <i>et al.</i>      | (CLEO Collab.)          |
| JUN         | 00  | PRL 84 1857            | S.Y. Jun <i>et al.</i>       | (FNAL SELEX Collab.)    |
| LINK        | 00  | PL B485 62             | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| LINK        | 00B | PL B491 232            | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
| Also        |     | PL B495 443 (errata)   | J.M. Link <i>et al.</i>      | (FNAL FOCUS Collab.)    |
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| AITALA      | 99G | PL B462 401            | E.M. Aitala <i>et al.</i>    | (FNAL E791 Collab.)     |
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| FRABETTI    | 96B | PL B382 312            | P.L. Frabetti <i>et al.</i>  | (FNAL E687 Collab.)     |
| FREYBERGER  | 96  | PRL 76 3065            | A. Freyberger <i>et al.</i>  | (CLEO Collab.)          |
| Also        |     | PRL 77 2147 (erratum)  | A. Freyberger <i>et al.</i>  | (CLEO Collab.)          |
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| ALBRECHT    | 94I | ZPHY C64 375           | H. Albrecht <i>et al.</i>        | (ARGUS Collab.)       |
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| BARLAG      | 92C | ZPHY C55 383           | S. Barlag <i>et al.</i>          | (ACCMOR Collab.)      |
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| AMMAR       | 91  | PR D44 3383            | R. Ammar <i>et al.</i>           | (CLEO Collab.)        |
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