# $f_1(1420)$

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

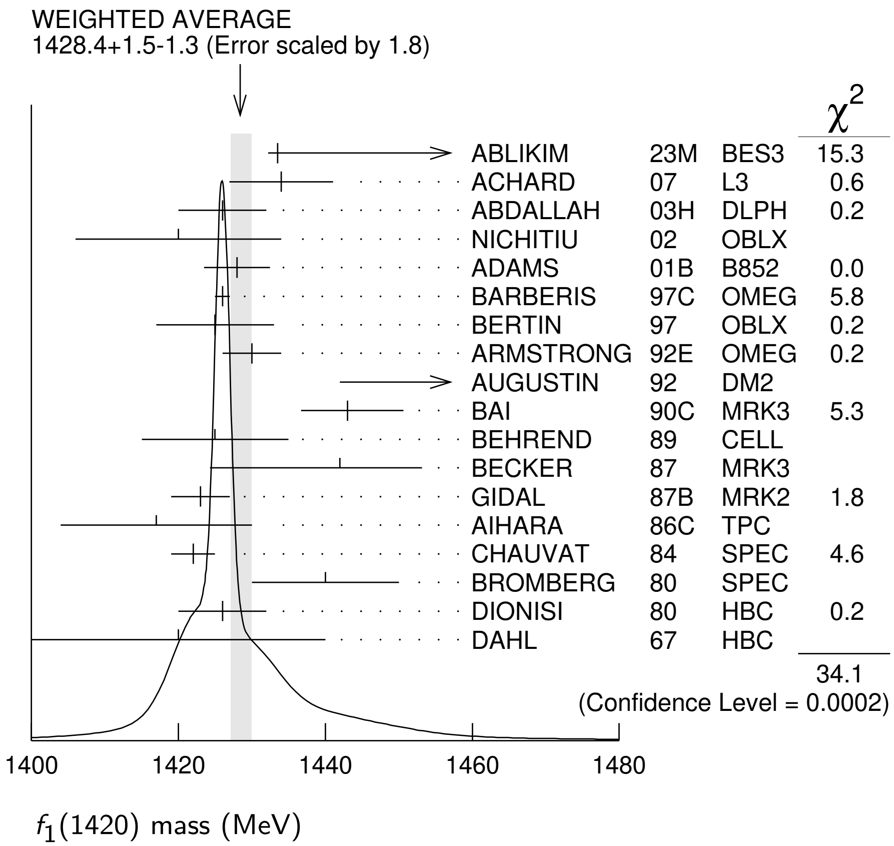
See the review on "Spectroscopy of Light Meson Resonances."

## $f_1(1420)$ MASS

| VALUE (MeV) | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$1428.4^{+1.5}_{-1.3}$ OUR AVERAGE** Error includes scale factor of 1.8. See the ideogram below. | | | | | |
| $1433.5 \pm 1.1^{+27.9}_{-0.7}$ | 126K | ABLIKIM | 23M | BES3 | $J/\psi \to \gamma K^0_S K^0_S \pi^0$ |
| $1434 \pm 5 \pm 5$ | 133 | [1] ACHARD | 07 | L3 | 183–209 $e^+ e^- \to e^+ e^- K^0_S K^\pm \pi^\mp$ |
| $1426 \pm 6$ | 711 | ABDALLAH | 03H | DLPH | 91.2 $e^+ e^- \to K^0_S K^\pm \pi^\mp + X$ |
| $1420 \pm 14$ | 3651 | NICHITIU | 02 | OBLX | 0 $\overline{p} p \to K^+ K^- \pi^+ \pi^- \pi^0$ |
| $1428 \pm 4 \pm 2$ | 20k | ADAMS | 01B | B852 | 18 GeV $\pi^- p \to K^+ K^- \pi^0 n$ |
| $1426 \pm 1$ | | BARBERIS | 97C | OMEG | 450 $p p \to p p K^0_S K^\pm \pi^\mp$ |
| $1425 \pm 8$ | | BERTIN | 97 | OBLX | 0.0 $\overline{p} p \to K^\pm (K^0) \pi^\mp \pi^+ \pi^-$ |
| $1430 \pm 4$ | | [2] ARMSTRONG | 92E | OMEG | 85,300 $\pi^+ p$, $p p \to \pi^+ p$, $p p (K \overline{K} \pi)$ |
| $1462 \pm 20$ | | [3] AUGUSTIN | 92 | DM2 | $J/\psi \to \gamma K \overline{K} \pi$ |
| $1443 {}^{+7}_{-6} {}^{+3}_{-2}$ | 1100 | BAI | 90C | MRK3 | $J/\psi \to \gamma K^0_S K^\pm \pi^\mp$ |
| $1425 \pm 10$ | 17 | BEHREND | 89 | CELL | $\gamma\gamma \to K^0_S K^\pm \pi^\mp$ |
| $1442 \pm 5 {}^{+10}_{-17}$ | 111 | BECKER | 87 | MRK3 | $e^+ e^-$, $\omega K \overline{K} \pi$ |
| $1423 \pm 4$ | | GIDAL | 87B | MRK2 | $e^+ e^- \to e^+ e^- K \overline{K} \pi$ |
| $1417 \pm 13$ | 13 | AIHARA | 86C | TPC | $e^+ e^- \to e^+ e^- K \overline{K} \pi$ |
| $1422 \pm 3$ | | CHAUVAT | 84 | SPEC | ISR 31.5 $p p$ |
| $1440 \pm 10$ | | [4] BROMBERG | 80 | SPEC | 100 $\pi^- p \to K \overline{K} \pi X$ |
| $1426 \pm 6$ | 221 | DIONISI | 80 | HBC | 4 $\pi^- p \to K \overline{K} \pi n$ |
| $1420 \pm 20$ | | DAHL | 67 | HBC | 1.6–4.2 $\pi^- p$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $1430.8 \pm 0.9$ | | [5] SOSA | 99 | SPEC | $p p \to p_{slow} (K^0_S K^+ \pi^-) p_{fast}$ |
| $1433.4 \pm 0.8$ | | [5] SOSA | 99 | SPEC | $p p \to p_{slow} (K^0_S K^- \pi^+) p_{fast}$ |
| $1435 \pm 9$ | | PROKOSHKIN | 97B | GAM4 | 100 $\pi^- p \to \eta \pi^0 \pi^0 n$ |
| $1429 \pm 3$ | 389 | ARMSTRONG | 89 | OMEG | 300 $p p \to K \overline{K} \pi p p$ |
| $1425 \pm 2$ | 1520 | ARMSTRONG | 84 | OMEG | 85 $\pi^+ p$, $p p \to (\pi^+, p)(K \overline{K} \pi) p$ |
| $\sim 1420$ | | BITYUKOV | 84 | SPEC | 32 $K^- p \to K^+ K^- \pi^0 Y$ |

[1] From a fit with a width fixed at 55 MeV.

[2] This result supersedes ARMSTRONG 84, ARMSTRONG 89.
[3] From fit to the $K^*(892)K$ $1^{++}$ partial wave.
[4] Mass error increased to account for $a_0(980)$ mass cut uncertainties.
[5] No systematic error given.




## $f_1$(1420) WIDTH

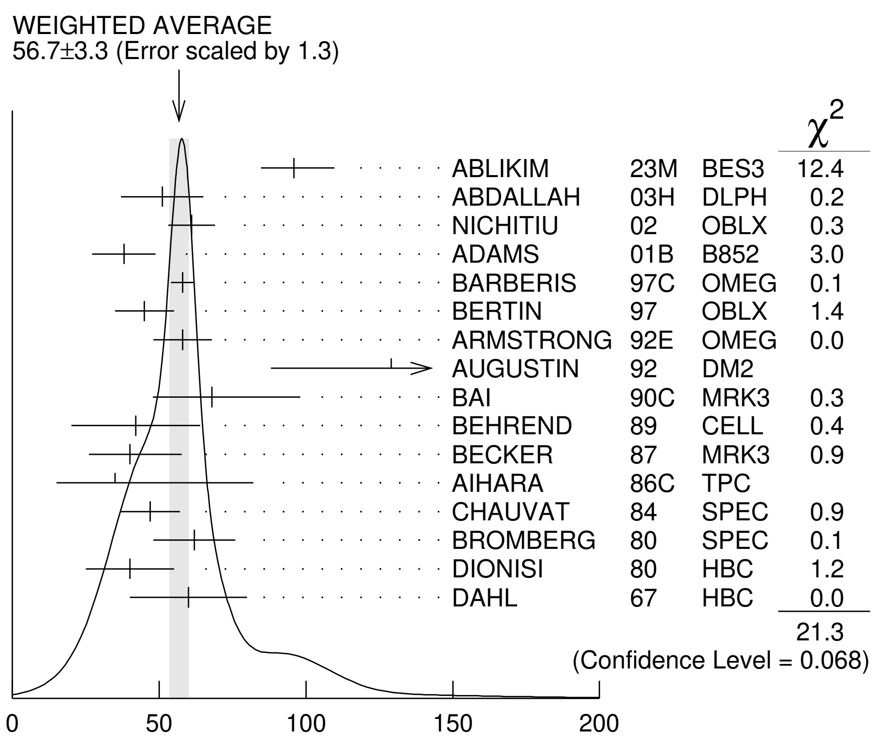
| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **56.7± 3.3 OUR AVERAGE** | | Error includes scale factor of 1.3. See the ideogram below. | | |
| $95.9 \pm 2.3^{+13.6}_{-10.9}$ | 126K | ABLIKIM | 23M BES3 | $J/\psi \rightarrow \gamma K^0_S K^0_S \pi^0$ |
| $51 \pm 14$ | 711 | ABDALLAH | 03H DLPH | 91.2 $e^+ e^- \rightarrow K^0_S K^\pm \pi^\mp + X$ |
| $61 \pm 8$ | 3651 | NICHITIU | 02 OBLX | 0 $\overline{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$ |
| $38 \pm 9 \pm 6$ | 20k | ADAMS | 01B B852 | 18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$ |
| $58 \pm 4$ | | BARBERIS | 97C OMEG | 450 $pp \rightarrow pp K^0_S K^\pm \pi^\mp$ |
| $45 \pm 10$ | | BERTIN | 97 OBLX | 0.0 $\overline{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$ |
| $58 \pm 10$ | | [6] ARMSTRONG | 92E OMEG | 85,300 $\pi^+ p$, $pp \rightarrow \pi^+ p$, $pp(K\overline{K}\pi)$ |
| $129 \pm 41$ | | [7] AUGUSTIN | 92 DM2 | $J/\psi \rightarrow \gamma K\overline{K}\pi$ |

| | | | | | | |
|---|---|---|---|---|---|---|
| 68 $^{+29}_{-18}$ $^{+\ 8}_{-\ 9}$ | 1100 | BAI | 90C | MRK3 | $J/\psi \to \gamma K^0_S K^\pm \pi^\mp$ |
| 42 $\pm 22$ | 17 | BEHREND | 89 | CELL | $\gamma\gamma \to K^0_S K^\pm \pi^\mp$ |
| 40 $^{+17}_{-13}$ $\pm$ 5 | 111 | BECKER | 87 | MRK3 | $e^+ e^- \to \omega K \overline{K} \pi$ |
| 35 $^{+47}_{-20}$ | 13 | AIHARA | 86C | TPC | $e^+ e^- \to e^+ e^- K \overline{K} \pi$ |
| 47 $\pm 10$ | | CHAUVAT | 84 | SPEC | ISR 31.5 $p p$ |
| 62 $\pm 14$ | | BROMBERG | 80 | SPEC | 100 $\pi^- p \to K \overline{K} \pi X$ |
| 40 $\pm 15$ | 221 | DIONISI | 80 | HBC | 4 $\pi^- p \to K \overline{K} \pi n$ |
| 60 $\pm 20$ | | DAHL | 67 | HBC | 1.6–4.2 $\pi^- p$ |

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

| | | | | | |
|---|---|---|---|---|---|
| 68.7 $\pm$ 2.9 | | [8] SOSA | 99 | SPEC | $p p \to p_{\text{slow}} (K^0_S K^+ \pi^-) p_{\text{fast}}$ |
| 58.8 $\pm$ 3.3 | | [8] SOSA | 99 | SPEC | $p p \to p_{\text{slow}} (K^0_S K^- \pi^+) p_{\text{fast}}$ |
| 90 $\pm 25$ | | PROKOSHKIN | 97B | GAM4 | 100 $\pi^- p \to \eta \pi^0 \pi^0 n$ |
| 58 $\pm$ 8 | 389 | ARMSTRONG | 89 | OMEG | 300 $p p \to K \overline{K} \pi p p$ |
| 62 $\pm$ 5 | 1520 | ARMSTRONG | 84 | OMEG | 85 $\pi^+ p$, $p p \to (\pi^+, p)(K \overline{K} \pi) p$ |
| $\sim$ 50 | | BITYUKOV | 84 | SPEC | 32 $K^- p \to K^+ K^- \pi^0 Y$ |

[6] This result supersedes ARMSTRONG 84, ARMSTRONG 89.
[7] From fit to the $K^*(892) K$ $1^{++}$ partial wave.
[8] No systematic error given.




$f_1(1420)$ WIDTH (MeV)

## $f_1(1420)$ DECAY MODES

| | Mode | Fraction $(\Gamma_i/\Gamma)$ |
|---|---|---|
| $\Gamma_1$ | $K\overline{K}\pi$ | seen |
| $\Gamma_2$ | $K\overline{K}^*(892)+$ c.c. | seen |
| $\Gamma_3$ | $\eta\pi\pi$ | possibly seen |
| $\Gamma_4$ | $a_0(980)\pi$ | |
| $\Gamma_5$ | $\pi\pi\rho$ | |
| $\Gamma_6$ | $4\pi$ | |
| $\Gamma_7$ | $\rho^0\gamma$ | |
| $\Gamma_8$ | $\phi\gamma$ | seen |

## $f_1(1420)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

### $\Gamma(K\overline{K}\pi) \times \Gamma(\gamma\gamma^*)/\Gamma_{\text{total}}$

| VALUE (keV) | CL% | EVTS | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|---|
| **1.9±0.4 OUR AVERAGE** | | | | | | | |
| $3.2\pm0.6\pm0.7$ | | 133 | 9,10 | ACHARD | 07 | L3 | 183–209 $e^+e^- \to e^+e^- K^0_S K^\pm \pi^\mp$ |
| $3.0\pm0.9\pm0.7$ | | | 11,12 | BEHREND | 89 | CELL | $e^+e^- \to e^+e^- K^0_S K\pi$ |
| $2.3^{+1.0}_{-0.9}\pm0.8$ | | | | HILL | 89 | JADE | $e^+e^- \to e^+e^- K^\pm K^0_S \pi^\mp$ |
| $1.3\pm0.5\pm0.3$ | | | | AIHARA | 88B | TPC | $e^+e^- \to e^+e^- K^\pm K^0_S \pi^\mp$ |
| $1.6\pm0.7\pm0.3$ | | | 11,13 | GIDAL | 87B | MRK2 | $e^+e^- \to e^+e^- K\overline{K}\pi$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | | |
| $<8.0$ | 95 | | | JENNI | 83 | MRK2 | $e^+e^- \to e^+e^- K\overline{K}\pi$ |

[9] From a fit with a width fixed at 55 MeV.
[10] The form factor parameter from the fit is 926 ± 78 MeV.
[11] Assume a $\rho$-pole form factor.
[12] A $\phi$ - pole form factor gives considerably smaller widths.
[13] Published value divided by 2.

## $f_1(1420)$ BRANCHING RATIOS

### $\Gamma(K\overline{K}^*(892)+\text{c.c.})/\Gamma(K\overline{K}\pi)$ — $\Gamma_2/\Gamma_1$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $0.76\pm0.06$ | BROMBERG | 80 | SPEC | 100 $\pi^- p \to K\overline{K}\pi X$ |
| $0.86\pm0.12$ | DIONISI | 80 | HBC | 4 $\pi^- p \to K\overline{K}\pi n$ |

### $\Gamma(\pi\pi\rho)/\Gamma(K\overline{K}\pi)$ — $\Gamma_5/\Gamma_1$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $<0.3$ | 95 | CORDEN | 78 | OMEG | 12–15 $\pi^- p$ |
| $<2.0$ | | DAHL | 67 | HBC | 1.6–4.2 $\pi^- p$ |

### $\Gamma(\eta\pi\pi)/\Gamma(K\overline{K}\pi)$ — $\Gamma_3/\Gamma_1$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.1** | 95 | ARMSTRONG | 91B | OMEG | 300 $pp \to pp\eta\pi^+\pi^-$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $1.35\pm0.75$ | | KOPKE | 89 | MRK3 | $J/\psi \to \omega\eta\pi\pi(K\overline{K}\pi)$ |
| $<0.6$ | 90 | GIDAL | 87 | MRK2 | $e^+e^- \to e^+e^-\eta\pi^+\pi^-$ |
| $<0.5$ | 95 | CORDEN | 78 | OMEG | 12–15 $\pi^- p$ |
| $1.5\ \pm0.8$ | | DEFOIX | 72 | HBC | 0.7 $\overline{p}p$ |

### $\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$ — $\Gamma_4/\Gamma_3$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $>0.1$ | 90 | PROKOSHKIN | 97B | GAM4 | 100 $\pi^- p \to \eta\pi^0\pi^0 n$ |
| not seen in either mode | | ANDO | 86 | SPEC | 8 $\pi^- p$ |
| not seen in either mode | | CORDEN | 78 | OMEG | 12–15 $\pi^- p$ |
| $0.4\pm0.2$ | | DEFOIX | 72 | HBC | 0.7 $\overline{p}p \to 7\pi$ |

### $\Gamma(4\pi)/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — $\Gamma_6/\Gamma_2$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $<0.90$ | 95 | DIONISI | 80 | HBC | 4 $\pi^- p$ |

### $\Gamma(K\overline{K}\pi)/[\Gamma(K\overline{K}^*(892)+\text{c.c.})+\Gamma(a_0(980)\pi)]$ — $\Gamma_1/(\Gamma_2+\Gamma_4)$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $0.65\pm0.27$ | [14] DIONISI | 80 | HBC | 4 $\pi^- p$ |

[14] Calculated using $\Gamma(K\overline{K})/\Gamma(\eta\pi) = 0.24 \pm 0.07$ for $a_0(980)$ fractions.

### $\Gamma(a_0(980)\pi)/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — $\Gamma_4/\Gamma_2$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.042±0.014 OUR AVERAGE** | | | | | |
| $0.44\ \pm0.19$ | | ABLIKIM | 21U | BES3 | $D_s^+ \to f_1(1420)\pi^+$ |
| $0.04\ \pm0.01\ \pm0.01$ | | BARBERIS | 98C | OMEG | 450 $pp \to p_f f_1(1420) p_s$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $<0.04$ | 68 | ARMSTRONG | 84 | OMEG | 85 $\pi^+ p$ |

### $\Gamma(4\pi)/\Gamma(K\overline{K}\pi)$ — $\Gamma_6/\Gamma_1$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.62** | 95 | ARMSTRONG | 89G | OMEG | 85 $\pi p \to 4\pi X$ |

### $\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$ — $\Gamma_7/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $<0.08$ | 95 | [15] ARMSTRONG | 92C | SPEC | 300 $pp \to pp\pi^+\pi^-\gamma$ |

[15] Using the data on the $\overline{K}K\pi$ mode from ARMSTRONG 89.

### $\Gamma(\rho^0\gamma)/\Gamma(K\overline{K}\pi)$ $\Gamma_7/\Gamma_1$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.02** | 95 | BARBERIS | 98C | OMEG | 450 $pp \to p_f f_1(1420) p_s$ |

### $\Gamma(\phi\gamma)/\Gamma(K\overline{K}\pi)$ $\Gamma_8/\Gamma_1$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.003±0.001±0.001** | BARBERIS | 98C | OMEG | 450 $pp \to p_f f_1(1420) p_s$ |

## $f_1(1420)$ REFERENCES


| | | | | |
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| AUGUSTIN | 92 | PR D46 1951 | J.E. Augustin, G. Cosme | (DM2 Collab.) |
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