# $\pi_1(1400)$

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

Coupled channel analyses favor the existence of only one broad $1^{-+}$ isovector state consistent with $\pi_1(1600)$ in the 1400–1600 MeV region. See the review on "Spectroscopy of Light Meson Resonances." See also $\pi_1(1600)$.

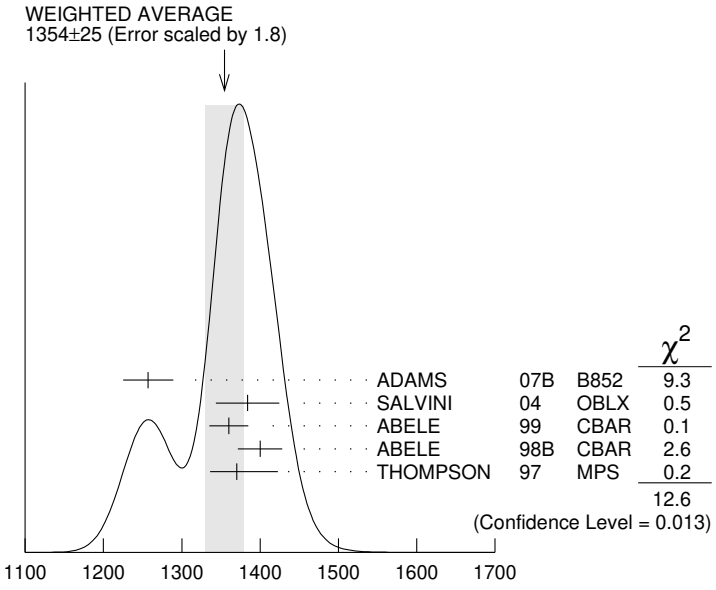
## $\pi_1(1400)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma \approx 2\ \mathrm{Im}(\sqrt{s})$.

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **$(1405 \pm 4^{+15}_{-18}) - i\,(314 \pm 14^{+18}_{-69})$ OUR ESTIMATE** | | | | |
| $(1405 \pm 4^{+15}_{-18}) - i\,(314 \pm 14^{+18}_{-69})$ | ALBRECHT | 20 | RVUE | $\overline{p}p \to \pi^0\pi^0\eta$ |

## $\pi_1(1400)$ MASS

| *VALUE* (MeV) | | | *EVTS* | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|---|---|---|
| **1354** | **±25** | **OUR AVERAGE** | | Error includes scale factor of 1.8. See the ideogram below. | | | | |
| 1257 | ±20 | ±25 | 23.5k | ADAMS | 07B | B852 | | 18 $\pi^- p \to \eta\pi^0 n$ |
| 1384 | ±20 | ±35 | 90k | SALVINI | 04 | OBLX | | $\overline{p}p \to 2\pi^+ 2\pi^-$ |
| 1360 | ±25 | | | ABELE | 99 | CBAR | | 0.0 $\overline{p}p \to \pi^0\pi^0\eta$ |
| 1400 | ±20 | ±20 | | ABELE | 98B | CBAR | | 0.0 $\overline{p}n \to \pi^-\pi^0\eta$ |
| 1370 | ±16 | $^{+50}_{-30}$ | | [1] THOMPSON | 97 | MPS | | 18 $\pi^- p \to \eta\pi^- p$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | | | |
| 1323.1 | ± 4.6 | | | [2] AOYAGI | 93 | BKEI | | $\pi^- p \to \eta\pi^- p$ |
| 1406 | ±20 | | | [3] ALDE | 88B | GAM4 | 0 | 100 $\pi^- p \to \eta\pi^0 n$ |




[1] Natural parity exchange, questioned by DZIERBA 03.

[2] Unnatural parity exchange.
[3] Seen in the $P_0$-wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.

## $\pi_1(1400)$ WIDTH

| *VALUE* (MeV) | | | *EVTS* | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|---|---|---|
| **330** | **±35** | **OUR AVERAGE** | | | | | | |
| 354 | ±64 | ± 58 | 23.5k | ADAMS | 07B | B852 | | 18 $\pi^- p \to \eta\pi^0 n$ |
| 378 | ±50 | ± 50 | 90k | SALVINI | 04 | OBLX | | $\overline{p}p \to 2\pi^+ 2\pi^-$ |
| 220 | ±90 | | | ABELE | 99 | CBAR | | 0.0 $\overline{p}p \to \pi^0\pi^0\eta$ |
| 310 | ±50 | $^{+\ 50}_{-\ 30}$ | | ABELE | 98B | CBAR | | 0.0 $\overline{p}n \to \pi^-\pi^0\eta$ |
| 385 | ±40 | $^{+\ 65}_{-105}$ | | [1] THOMPSON | 97 | MPS | | 18 $\pi^- p \to \eta\pi^- p$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | | | |
| 143.2 | ±12.5 | | | [2] AOYAGI | 93 | BKEI | | $\pi^- p \to \eta\pi^- p$ |
| 180 | ±20 | | | [3] ALDE | 88B | GAM4 | 0 | 100 $\pi^- p \to \eta\pi^0 n$ |

[1] Resolution is not unfolded, natural parity exchange, questioned by DZIERBA 03.
[2] Unnatural parity exchange.
[3] Seen in the $P_0$-wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.

## $\pi_1(1400)$ DECAY MODES

| | Mode | Fraction ($\Gamma_i/\Gamma$) |
|---|---|---|
| $\Gamma_1$ | $\eta\pi^0$ | seen |
| $\Gamma_2$ | $\eta\pi^-$ | seen |
| $\Gamma_3$ | $\eta'\pi$ | |
| $\Gamma_4$ | $\rho(770)\pi$ | not seen |

## $\pi_1(1400)$ BRANCHING RATIOS

### $\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma$

| *VALUE* | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| not seen | PROKOSHKIN | 95B | GAM4 | | 100 $\pi^- p \to \eta\pi^0 n$ |
| not seen | [1] BUGG | 94 | RVUE | | $\overline{p}p \to \eta 2\pi^0$ |
| not seen | [2] APEL | 81 | NICE | 0 | 40 $\pi^- p \to \eta\pi^0 n$ |

[1] Using Crystal Barrel data.
[2] A general fit allowing $S$, $D$, and $P$ waves (including $m$=0) is not done because of limited statistics.

### $\Gamma(\eta\pi^-)/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma$

| *VALUE* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| possibly seen | BELADIDZE | 93 | VES | $37\pi^- N \to \eta\pi^- N$ |

### $\Gamma(\eta'\pi)/\Gamma(\eta\pi^0)$ $\Gamma_3/\Gamma_1$

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $<0.80$ | 95 | BOUTEMEUR 90 | GAM4 | 100 $\pi^- p \rightarrow 4\gamma n$ |

### $\Gamma(\rho(770)\pi)/\Gamma_{\text{total}}$ $\Gamma_4/\Gamma$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|
| **not seen** | AGHASYAN 18B | COMP | 190 $\pi^- p \rightarrow \pi^-\pi^+\pi^- p$ |

## $\pi_1(1400)$ REFERENCES


| | | | | |
|---|---|---|---|---|
| ALBRECHT | 20 | EPJ C80 453 | M. Albrecht *et al.* | (Crystal Barrel Collab.) |
| AGHASYAN | 18B | PR D98 092003 | M. Aghasyan *et al.* | (COMPASS Collab.) |
| ADAMS | 07B | PL B657 27 | G.S. Adams *et al.* | (BNL E852 Collab.) |
| SALVINI | 04 | EPJ C35 21 | P. Salvini *et al.* | (OBELIX Collab.) |
| DZIERBA | 03 | PR D67 094015 | A.R. Dzierba *et al.* | |
| ABELE | 99 | PL B446 349 | A. Abele *et al.* | (Crystal Barrel Collab.) |
| ABELE | 98B | PL B423 175 | A. Abele *et al.* | (Crystal Barrel Collab.) |
| THOMPSON | 97 | PRL 79 1630 | D.R. Thompson *et al.* | (BNL E852 Collab.) |
| PROKOSHKIN | 95B | PAN 58 606 | Y.D. Prokoshkin, S.A. Sadovsky | (SERP) |
| | | Translated from YAF 58 662. | | |
| BUGG | 94 | PR D50 4412 | D.V. Bugg *et al.* | (LOQM) |
| AOYAGI | 93 | PL B314 246 | H. Aoyagi *et al.* | (BKEI Collab.) |
| BELADIDZE | 93 | PL B313 276 | G.M. Beladidze *et al.* | (VES Collab.) |
| BOUTEMEUR | 90 | Hadron 89 Conf. p 119 | M. Boutemeur, M. Poulet | (SERP, BELG, LANL+) |
| ALDE | 88B | PL B205 397 | D.M. Alde *et al.* | (SERP, BELG, LANL, LAPP) IGJPC |
| APEL | 81 | NP B193 269 | W.D. Apel *et al.* | (SERP, CERN) |