

# η(1440)

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

See also the mini-review under non- $q\bar{q}$  candidates. (See the index for the page number.)

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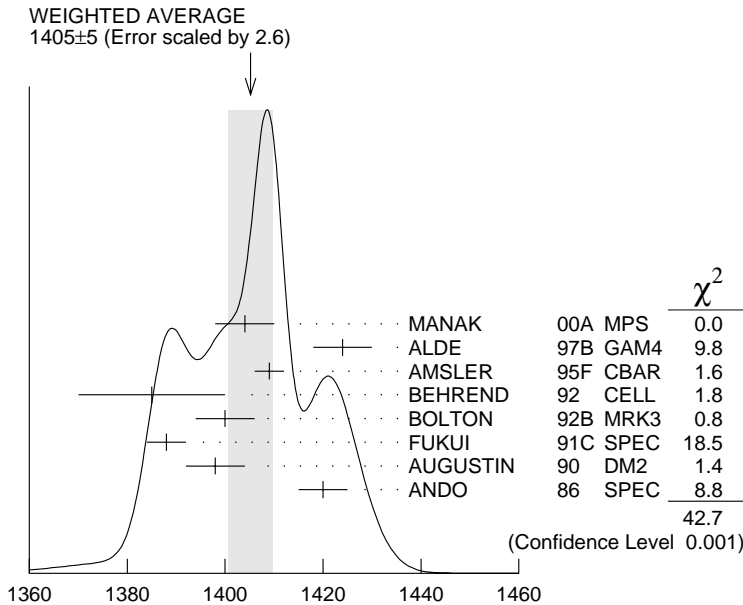
## η(1440) MASS

VALUE (MeV)                      DOCUMENT ID  
**1400 - 1470 OUR ESTIMATE**      Contains possibly two overlapping pseudoscalars.

### ηππ MODE

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1405 ± 5 OUR AVERAGE</b>				Error includes scale factor of 2.6. See the ideogram below.
1404 ± 6	9082	MANAK	00A MPS	18 π <sup>-</sup> p → ηπ <sup>+</sup> π <sup>-</sup> n
1424 ± 6	2200	ALDE	97B GAM4	100 π <sup>-</sup> p → ηπ <sup>0</sup> π <sup>0</sup> n
1409 ± 3		AMSLER	95F CBAR	0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$
1385 ± 15		<sup>1</sup> BEHREND	92 CELL	J/ψ → γηπ <sup>+</sup> π <sup>-</sup>
1400 ± 6		<sup>1</sup> BOLTON	92B MRK3	J/ψ → γηπ <sup>+</sup> π <sup>-</sup>
1388 ± 4		FUKUI	91C SPEC	8.95 π <sup>-</sup> p → ηπ <sup>+</sup> π <sup>-</sup> n
1398 ± 6	261	<sup>2</sup> AUGUSTIN	90 DM2	J/ψ → γηπ <sup>+</sup> π <sup>-</sup>
1420 ± 5		ANDO	86 SPEC	8 π <sup>-</sup> p → ηπ <sup>+</sup> π <sup>-</sup> n
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1385 ± 7		BAI	99 BES	J/ψ → γπ <sup>+</sup> π <sup>-</sup>

<sup>1</sup> From fit to the  $a_0(980)\pi^0$  partial wave.  
<sup>2</sup> Best fit with a single Breit Wigner.



η(1440) mass, ηππ mode (MeV)

## $\pi\pi\gamma$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1401 \pm 18$	<sup>3,4</sup> AUGUSTIN	90 DM2	$J/\psi \rightarrow \pi^+ \pi^- \gamma \gamma$
$1432 \pm 8$	<sup>4</sup> COFFMAN	90 MRK3	$J/\psi \rightarrow \pi^+ \pi^- 2\gamma$

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

<sup>3</sup> Best fit with a single Breit Wigner.

<sup>4</sup> This peak in the  $\gamma\rho$  channel may not be related to the  $\eta(1440)$ .

## $4\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1420 \pm 20$		BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
$1489 \pm 12$	3270	<sup>5</sup> BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

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

<sup>5</sup> Estimated by us from various fits.

## $K\bar{K}\pi$ MODE ( $a_0(980)$ $\pi$ dominant)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>1418.4 \pm 1.4</math> OUR AVERAGE</b>		Error includes scale factor of 1.8.		See the ideogram below.
$1405 \pm 5$		<sup>6</sup> CICALO	99 OBLX	$0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
$1407 \pm 5$		<sup>6</sup> BERTIN	97 OBLX	$0 \bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
$1416 \pm 2$		<sup>6</sup> BERTIN	95 OBLX	$0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
$1416 \pm 8 \begin{smallmatrix} +7 \\ -5 \end{smallmatrix}$	700	<sup>7</sup> BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
$1413 \pm 8$	500	DUCH	89 ASTE	$\bar{p}p \rightarrow \pi^+ \pi^- K^\pm \pi^\mp K^0$
$1413 \pm 5$		<sup>7</sup> RATH	89 MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$
$1419 \pm 1$	8800	BIRMAN	88 MPS	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
$1424 \pm 3$	620	REEVES	86 SPEC	$6.6 p\bar{p} \rightarrow K\bar{K}\pi X$
$1421 \pm 2$		CHUNG	85 SPEC	$8 \pi^- p \rightarrow K\bar{K}\pi n$

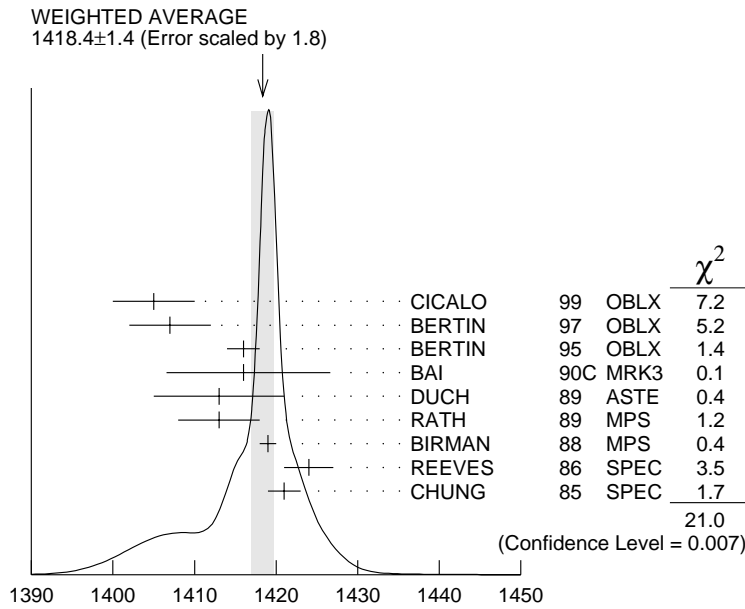
••• We do not use the following data for averages, fits, limits, etc. •••

$1459 \pm 5$  <sup>8</sup> AUGUSTIN 92 DM2  $J/\psi \rightarrow \gamma K\bar{K}\pi$

<sup>6</sup> Decaying into  $(K\bar{K})_S\pi$ ,  $(K\pi)_S\bar{K}$ , and  $a_0(980)\pi$ .

<sup>7</sup> From fit to the  $a_0(980)\pi 0^-+$  partial wave. Cannot rule out a  $a_0(980)\pi 1^++$  partial wave.

<sup>8</sup> Excluded from averaging because averaging would be meaningless.



$\eta(1440)$  mass,  $K\bar{K}\pi$  mode ( $a_0(980)\pi$  dominant) (MeV)

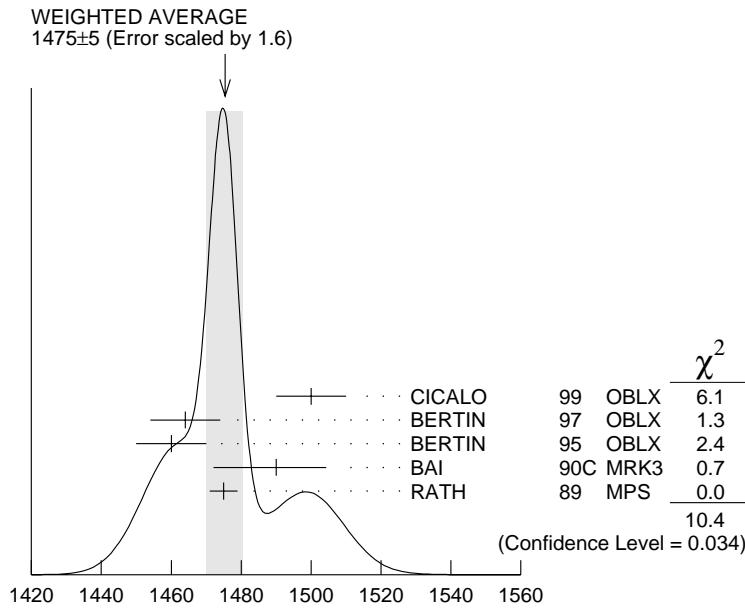
**$K\bar{K}\pi$  MODE ( $K^*(892)K$  dominant)**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1475± 5 OUR AVERAGE</b>	Error includes scale factor of 1.6. See the ideogram below.			
1500±10		CICALO	99 OBLX	$0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
1464±10		BERTIN	97 OBLX	$0 \bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1460±10		BERTIN	95 OBLX	$0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
1490 <sup>+14</sup> <sub>-8</sub> <sup>+3</sup> <sub>-16</sub>	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1475± 4		RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

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

1442±10	410	BAI	98C BES	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1421±14	<sup>9</sup>	AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$

<sup>9</sup> Excluded from averaging because averaging would be meaningless.



$\eta(1440)$  mass,  $K\bar{K}\pi$  mode ( $K^*(892) K$  dominant) (MeV)

### $K\bar{K}\pi$ MODE (unresolved)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1445 ± 8	693	AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1433 ± 8	296	AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1453 ± 7	170	RATH	89 MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
1440 <sup>+20</sup> <sub>-15</sub>	174	EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1440 <sup>+10</sup> <sub>-15</sub>		SCHARRE	80 MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 ± 7	800	<sup>10</sup> BAILLON	67 HBC	$0 \bar{p} p \rightarrow K\bar{K}\pi\pi\pi$

<sup>10</sup> From best fit of  $0^-+$  partial wave, 50%  $K^*(892) K$ , 50%  $a_0(980)\pi$ .



### $\pi\pi\gamma$ MODE

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$174 \pm 44$	AUGUSTIN	90 DM2	$J/\psi \rightarrow \pi^+ \pi^- \gamma \gamma$
$90 \pm 26$	<sup>13</sup> COFFMAN	90 MRK3	$J/\psi \rightarrow \pi^+ \pi^- 2\gamma$

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

<sup>13</sup> This peak in the  $\gamma\rho$  channel may not be related to the  $\eta(1440)$ .

### $4\pi$ MODE

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$160 \pm 30$		BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
$144 \pm 13$	3270	<sup>14</sup> BISELLO	89B DM2	$J/\psi \rightarrow 4\pi \gamma$

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

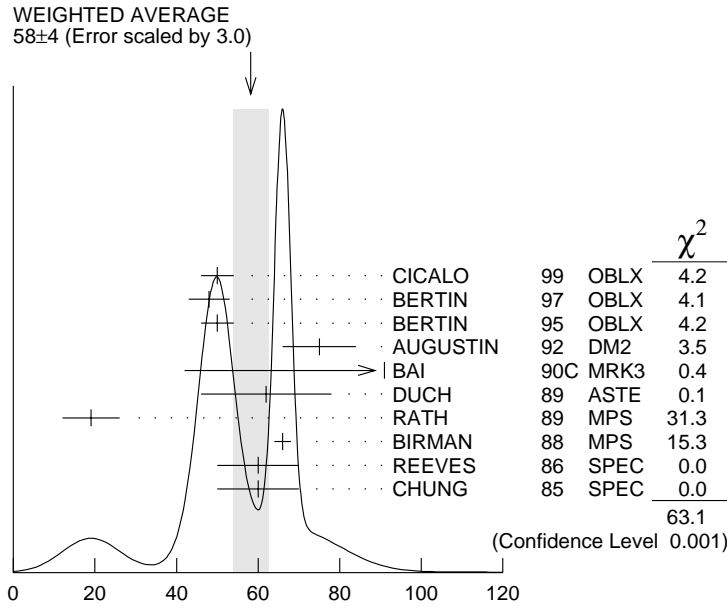
<sup>14</sup> Estimated by us from various fits.

### $K\bar{K}\pi$ MODE ( $a_0(980)\pi$ dominant)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>58 \pm 4</math></b>	<b>OUR AVERAGE</b> Error includes scale factor of 3.0. See the ideogram below.			
$50 \pm 4$		CICALO	99 OBLX	$0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
$48 \pm 5$		<sup>15</sup> BERTIN	97 OBLX	$0.0 \bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
$50 \pm 4$		<sup>15</sup> BERTIN	95 OBLX	$0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
$75 \pm 9$		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$
$91^{+67}_{-31} +^{15}_{-38}$		<sup>16</sup> BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
$62 \pm 16$	500	DUCH	89 ASTE	$\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
$19 \pm 7$		<sup>16</sup> RATH	89 MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$
$66 \pm 2$	8800	BIRMAN	88 MPS	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
$60 \pm 10$	620	REEVES	86 SPEC	$6.6 p\bar{p} \rightarrow K K \pi X$
$60 \pm 10$		CHUNG	85 SPEC	$8 \pi^- p \rightarrow K\bar{K}\pi n$

<sup>15</sup> Decaying into  $(K\bar{K})_S\pi$ ,  $(K\pi)_S\bar{K}$ , and  $a_0(980)\pi$ .

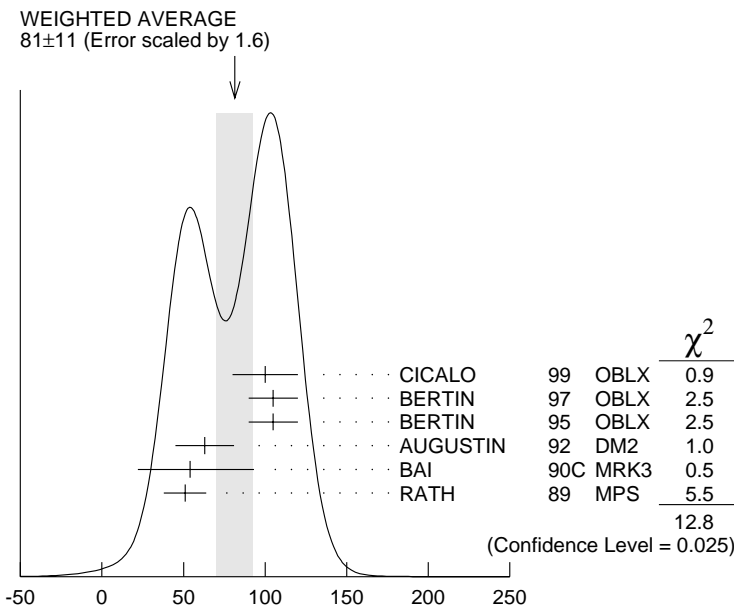
<sup>16</sup> From fit to the  $a_0(980)\pi 0^{-+}$  partial wave, but  $a_0(980)\pi 1^{++}$  cannot be excluded.



$\eta(1440)$  width  $K\bar{K}\pi$  mode ( $a_0(980)\pi$  dominant)

### $K\bar{K}\pi$ MODE ( $K^*(892)$ $K$ dominant)

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b><math>81 \pm 11</math> OUR AVERAGE</b>	Error includes scale factor of 1.6. See the ideogram below.		
$100 \pm 20$	CICALO	99 OBLX	$0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
$105 \pm 15$	BERTIN	97 OBLX	$0.0 \bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
$105 \pm 15$	BERTIN	95 OBLX	$0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
$63 \pm 18$	AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$
$54^{+37+13}_{-21-24}$	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
$51 \pm 13$	RATH	89 MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$



$\eta(1440)$  width  $K\bar{K}\pi$  mode ( $K^*(892)$   $K$  dominant)

### $K\bar{K}\pi$ MODE (unresolved)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$93 \pm 14$	296	AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
$105 \pm 10$	693	AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
$100 \pm 11$	170	RATH	89 MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
$55^{+20}_{-30}$	174	EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
$50^{+30}_{-20}$		SCHARRE	80 MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
$80 \pm 10$	800	<sup>17</sup> BAILLON	67 HBC	$0.0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$



<sup>17</sup> From best fit to  $0^{-+}$  partial wave, 50%  $K^*(892)K$ , 50%  $a_0(980)\pi$ .

### $\eta(1440)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $K\bar{K}\pi$	seen
$\Gamma_2$ $K\bar{K}^*(892) + \text{c.c.}$	seen
$\Gamma_3$ $\eta\pi\pi$	seen
$\Gamma_4$ $a_0(980)\pi$	seen
$\Gamma_5$ $\eta(\pi\pi)_{S\text{-wave}}$	seen
$\Gamma_6$ $f_0(980)\eta$	seen
$\Gamma_7$ $4\pi$	seen
$\Gamma_8$ $\gamma\gamma$	
$\Gamma_9$ $\rho^0\gamma$	

### $\eta(1440)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_8/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.2	95	BEHREND	89 CELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$	
••• We do not use the following data for averages, fits, limits, etc. •••					
<1.6	95	AIHARA	86D TPC	$e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$	
<2.2	95	ALTHOFF	85B TASS	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$	
<8.0	95	JENNI	83 MRK2	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$	
$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_8/\Gamma$
VALUE (keV)		DOCUMENT ID	TECN	COMMENT	
••• We do not use the following data for averages, fits, limits, etc. •••					
<0.3		ANTREASYAN	87 CBAL	$e^+e^- \rightarrow e^+e^- \eta\pi\pi$	
$\Gamma(\rho^0\gamma) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_9\Gamma_8/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
••• We do not use the following data for averages, fits, limits, etc. •••					
<1.5	95	ALTHOFF	84E TASS	$e^+e^- \rightarrow e^+e^- \pi^+ \pi^- \gamma$	

### $\eta(1440)$ BRANCHING RATIOS

$\Gamma(\eta\pi\pi)/\Gamma(K\bar{K}\pi)$					$\Gamma_3/\Gamma_1$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
••• We do not use the following data for averages, fits, limits, etc. •••					
<0.5	90	EDWARDS	83B CBAL	$J/\psi \rightarrow \eta\pi\pi\gamma$	
<1.1	90	SCHARRE	80 MRK2	$J/\psi \rightarrow \eta\pi\pi\gamma$	
<1.5	95	FOSTER	68B HBC	$0.0 \bar{p}p$	

### $\Gamma(a_0(980)\pi)/\Gamma(K\bar{K}\pi)$

$\Gamma_4/\Gamma_1$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$\sim 0.15$		18 BERTIN	95 OBLX	$0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
$\sim 0.8$	500	18 DUCH	89 ASTE	$\bar{p}p \rightarrow$ $\pi^+\pi^-K^\pm\pi^\mp K^0$
$\sim 0.75$		18 REEVES	86 SPEC	$6.6 p\bar{p} \rightarrow K K\pi X$

<sup>18</sup> Assuming that the  $a_0(980)$  decays only into  $K\bar{K}$ .

### $\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$

$\Gamma_4/\Gamma_3$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.29 \pm 0.10$		ABELE	98E CBAR	$0 p\bar{p} \rightarrow \eta\pi^0\pi^0\pi^0$
$0.19 \pm 0.04$	2200	19 ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta\pi^0\pi^0 n$
$0.56 \pm 0.04 \pm 0.03$		19 AMSLER	95F CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$

<sup>19</sup> Assuming that the  $a_0(980)$  decays only into  $\eta\pi$ .

### $\Gamma(a_0(980)\pi)/\Gamma(\eta(\pi\pi)s\text{-wave})$

$\Gamma_4/\Gamma_5$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.15 \pm 0.04$	9082	MANAK	00A MPS	$18 \pi^- p \rightarrow \eta\pi^+\pi^- n$
$0.70 \pm 0.12 \pm 0.20$		20 BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

<sup>20</sup> Assuming that the  $a_0(980)$  decays only into  $\eta\pi$ .

### $\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(K\bar{K}\pi)$

$\Gamma_2/\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
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<b>0.50 ± 0.10</b>	BAILLON	67 HBC	$0.0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
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### $\Gamma(K\bar{K}^*(892)+c.c.)/[\Gamma(K\bar{K}^*(892)+c.c.)+\Gamma(a_0(980)\pi)]$

$\Gamma_2/(\Gamma_2+\Gamma_4)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 0.25$	90	EDWARDS	82E CBAL	$J/\psi \rightarrow K^+K^-\pi^0\gamma$
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### $\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$

$\Gamma_9/\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
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<b>0.0152 ± 0.0038</b>	21 COFFMAN	90 MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
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<sup>21</sup> Using  $B(J/\psi \rightarrow \gamma\eta(1440) \rightarrow \gamma K\bar{K}\pi) = 4.2 \times 10^{-3}$  and  $B(J/\psi \rightarrow \gamma\eta(1440) \rightarrow \gamma\gamma\rho^0) = 6.4 \times 10^{-5}$  and assuming that the  $\gamma\rho^0$  signal does not come from the  $f_1(1420)$ .

### $\Gamma(\eta(\pi\pi)s\text{-wave})/\Gamma(\eta\pi\pi)$

$\Gamma_5/\Gamma_3$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.81 \pm 0.04$	2200	ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta\pi^0\pi^0 n$
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$\Gamma(a_0(980)\pi)/\Gamma(\eta(\pi\pi)S\text{-wave})$  $\Gamma_4/\Gamma_5$ 

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.32 ± 0.07                      22 ANISOVICH    99I SPEC    0.9–1.2  $\bar{p}p \rightarrow \eta 3\pi^0$ <sup>22</sup> Using preliminary Crystal Barrel data. $\eta(1440)$  REFERENCES

MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	
ANISOVICH	99I	PL B468 304	A.V. Anisovich <i>et al.</i>	
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)
ABELE	98E	NP B514 45	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BAI	98C	PL B440 217	J.Z. Bai <i>et al.</i>	(BES Collab.)
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 60 458.		
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AMSLER	95F	PL B358 389	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)
DUCH	89	ZPHY 45 223	K.D. Duch <i>et al.</i>	(ASTERIX Collab.) JP
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
ANTREASIAN	87	PR D36 2633	D. Antreasian <i>et al.</i>	(Crystal Ball Collab.)
AIHARA	86D	PRL 57 51	H. Aihara <i>et al.</i>	(TPC-2 $\gamma$ Collab.)
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP
REEVES	86	PR 34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+) JP
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+) JP
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
Also	83	PRL 50 219	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)
FOSTER	68B	NP B8 174	M. Foster <i>et al.</i>	(CERN, CDEF)
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)

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CLOSE	97B	PR D55 5749	F. Close <i>et al.</i>	(RAL, RUTG, BEIJT)
BERTIN	96	PL B385 493	A. Bertin <i>et al.</i>	(Obelix Collab.)
FARRAR	96	PRL 76 4111	G.R. Farrar	(RUTG)
AMELIN	95	ZPHY C66 71	D.V. Amelin <i>et al.</i>	(VES Collab.)
GENOVESE	94	ZPHY C61 425	M. Genovese, D.B. Lichtenberg, E. Predazzi	(TORI+)
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LONGACRE	90	PR D42 874	R.S. Longacre	(BNL)
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ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
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