

$a_2(1320)$

$$I^G(J^{PC}) = 1^-(2^{++})$$

 $a_2(1320)$ MASSVALUE (MeV)DOCUMENT ID

$1318.3^{+0.5}_{-0.6}$ OUR AVERAGE Includes data from the 4 datablocks that follow this one.
Error includes scale factor of 1.2.

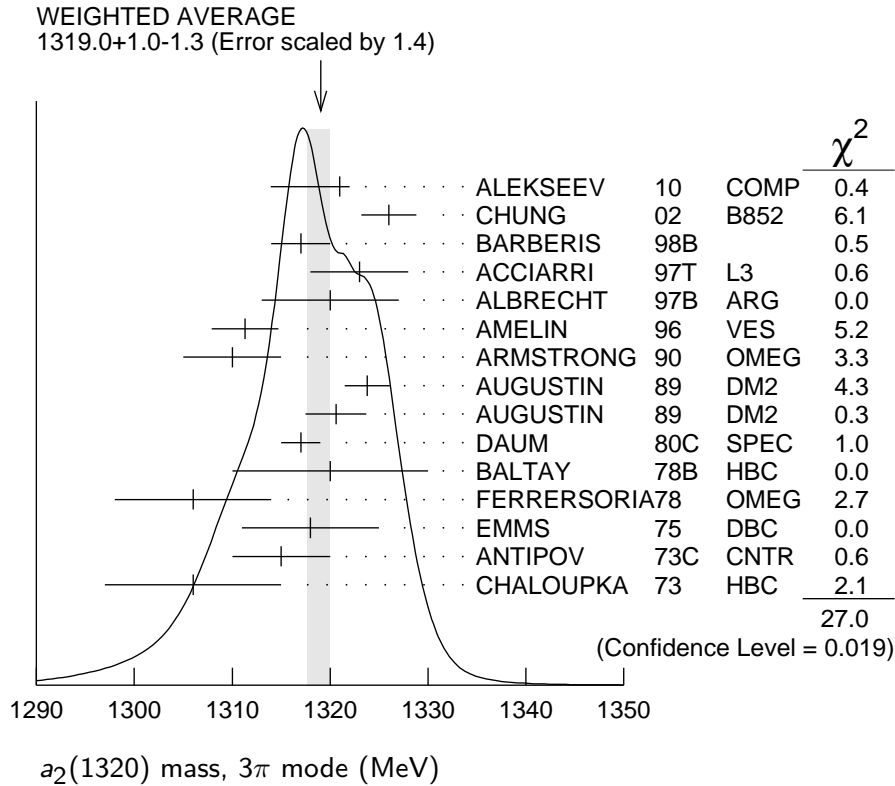
3 π MODEVALUE (MeV)EVTSDOCUMENT IDTECNCHGCOMMENT

The data in this block is included in the average printed for a previous datablock.

$1319.0^{+1.0}_{-1.3}$ OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1321	± 1	$^{+0}_{-7}$	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow$ $\pi^- \pi^- \pi^+ Pb'$
1326	± 2	± 2		CHUNG	02	B852	18.3 $\pi^- p \rightarrow$ $\pi^+ \pi^- \pi^- p$
1317	± 3			BARBERIS	98B		450 $pp \rightarrow$ $p_f \pi^+ \pi^- \pi^0 p_s$
1323	± 4	± 3		ACCIARRI	97T	L3	$e^+ e^- \rightarrow$ $e^+ e^- \pi^+ \pi^- \pi^0$
1320	± 7			ALBRECHT	97B	ARG	$e^+ e^- \rightarrow$ $e^+ e^- \pi^+ \pi^- \pi^0$
1311.3	± 1.6	± 3.0	72.4k	AMELIN	96	VES	36 $\pi^- p \rightarrow$ $\pi^+ \pi^- \pi^0 n$
1310	± 5			ARMSTRONG	90	OMEG 0	300.0 $pp \rightarrow$ $pp \pi^+ \pi^- \pi^0$
1323.8	± 2.3		4022	AUGUSTIN	89	DM2 \pm	$J/\psi \rightarrow \rho^\pm a_2^\mp$
1320.6	± 3.1		3562	AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$
1317	± 2		25k	¹ DAUM	80C	SPEC -	63,94 $\pi^- p \rightarrow 3\pi p$
1320	± 10		1097	¹ BALTAY	78B	HBC +0	15 $\pi^+ p \rightarrow p 4\pi$
1306	± 8			FERRERSORIA	78	OMEG -	9 $\pi^- p \rightarrow p 3\pi$
1318	± 7		1.6k	¹ EMMS	75	DBC 0	4 $\pi^+ n \rightarrow p(3\pi)^0$
1315	± 5			¹ ANTIPOV	73C	CNTR -	25,40 $\pi^- p \rightarrow$ $p \eta \pi^-$
1306	± 9		1580	CHALOUPKA	73	HBC -	3.9 $\pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●							
1300	± 2	± 4	18k	² SCHEGELSKY	06	RVUE 0	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
1305	± 14			CONDO	93	SHF	$\gamma p \rightarrow n \pi^+ \pi^+ \pi^-$
1310	± 2			¹ EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow 3\pi p$
1343	± 11		490	BALTAY	78B	HBC 0	15 $\pi^+ p \rightarrow \Delta 3\pi$
1309	± 5		5k	BINNIE	71	MMS -	$\pi^- p$ near a_2 thresh- old
1299	± 6		28k	BOWEN	71	MMS -	5 $\pi^- p$
1300	± 6		24k	BOWEN	71	MMS +	5 $\pi^+ p$
1309	± 4		17k	BOWEN	71	MMS -	7 $\pi^- p$
1306	± 4		941	ALSTON-...	70	HBC +	7.0 $\pi^+ p \rightarrow 3\pi p$

- ¹ From a fit to $J^P = 2^+ \rho\pi$ partial wave.
² From analysis of L3 data at 183–209 GeV.



$K\bar{K}$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT
 The data in this block is included in the average printed for a previous datablock.

1318.1± 0.7 OUR AVERAGE

1319 ± 5	4700	^{1,2} CLELAND	82B	SPEC	+	50 $\pi^+ p \rightarrow K_S^0 K^+ p$
1324 ± 6	5200	^{1,2} CLELAND	82B	SPEC	-	50 $\pi^- p \rightarrow K_S^0 K^- p$
1320 ± 2	4000	CHABAUD	80	SPEC	-	17 $\pi^- A \rightarrow K_S^0 K^- A$
1312 ± 4	11000	CHABAUD	78	SPEC	-	9.8 $\pi^- p \rightarrow K^- K_S^0 p$
1316 ± 2	4730	CHABAUD	78	SPEC	-	18.8 $\pi^- p \rightarrow K^- K_S^0 p$
1318 ± 1		^{1,3} MARTIN	78D	SPEC	-	10 $\pi^- p \rightarrow K_S^0 K^- p$
1320 ± 2	2724	MARGULIE	76	SPEC	-	23 $\pi^- p \rightarrow K^- K_S^0 p$
1313 ± 4	730	FOLEY	72	CNTR	-	20.3 $\pi^- p \rightarrow K^- K_S^0 p$
1319 ± 3	1500	³ GRAYER	71	ASPK	-	17.2 $\pi^- p \rightarrow K^- K_S^0 p$

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

1304 ± 10	870	⁴ SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1330 ± 11	1000	^{1,2} CLELAND	82B	SPEC	+	30 $\pi^+ p \rightarrow K_S^0 K^+ p$
1324 ± 5	350	HYAMS	78	ASPK	+	12.7 $\pi^+ p \rightarrow K^+ K_S^0 p$

- ¹ From a fit to $J^P = 2^+$ partial wave.
² Number of events evaluated by us.
³ Systematic error in mass scale subtracted.
⁴ From analysis of L3 data at 91 and 183–209 GeV.

$\eta\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

1317.7 ± 1.4 OUR AVERAGE

1308 ± 9		BARBERIS	00H		450 $p p \rightarrow p_f \eta \pi^0 p_S$
1316 ± 9		BARBERIS	00H		450 $p p \rightarrow \Delta_f^{++} \eta \pi^- p_S$
1317 ± 1 ± 2		THOMPSON	97	MPS	18 $\pi^- p \rightarrow \eta \pi^- p$
1315 ± 5 ± 2		¹ AMSLER	94D	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$
1325.1 ± 5.1		AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
1317.7 ± 1.4 ± 2.0		BELADIDZE	93	VES	37 $\pi^- N \rightarrow \eta \pi^- N$
1323 ± 8	1000	² KEY	73	OSPK	– 6 $\pi^- p \rightarrow p \pi^- \eta$

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

1315 ± 12		³ ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(l)} \pi^- p$
1309 ± 4		ANISOVICH	09	RVUE	$\bar{p} p, \pi N$
1324 ± 5		ARMSTRONG	93C	E760	0 $\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1336.2 ± 1.7	2561	DELFOSSÉ	81	SPEC	+ $\pi^\pm p \rightarrow p \pi^\pm \eta$
1330.7 ± 2.4	1653	DELFOSSÉ	81	SPEC	– $\pi^\pm p \rightarrow p \pi^\pm \eta$
1324 ± 8	6200	^{2,4} CONFORTO	73	OSPK	– 6 $\pi^- p \rightarrow p \pi^- \eta$

¹ The systematic error of 2 MeV corresponds to the spread of solutions.² Error includes 5 MeV systematic mass-scale error.³ ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.⁴ Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$. **$\eta'\pi$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

1322 ± 7 OUR AVERAGE

1318 ± 8 $\begin{smallmatrix} +3 \\ -5 \end{smallmatrix}$		IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
1327.0 ± 10.7		BELADIDZE	93	VES	37 $\pi^- N \rightarrow \eta' \pi^- N$

 $a_2(1320)$ WIDTH**3 π MODE**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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105.0 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 1.6 \\ 1.9 \end{smallmatrix}$ OUR AVERAGE

110 ± 2 $\begin{smallmatrix} +2 \\ -15 \end{smallmatrix}$	420k	ALEKSEEV	10	COMP	190 $\pi^- P b \rightarrow \pi^- \pi^- \pi^+ P b'$
108 ± 3 ± 15		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
120 ± 10		BARBERIS	98B		450 $p p \rightarrow p_f \pi^+ \pi^- \pi^0 p_S$
105 ± 10 ± 11		ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
120 ± 10		ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

103.0± 6.0± 3.3 72.4k	AMELIN	96	VES	36	$\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
120 ±10	ARMSTRONG	90	OMEG 0	300.0	$pp \rightarrow p p \pi^+ \pi^- \pi^0$
107.0± 9.7 4022	AUGUSTIN	89	DM2 ±	$J/\psi \rightarrow \rho^\pm a_2^\mp$	
118.5±12.5 3562	AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$	
97 ± 5	¹ EVANGELIS...	81	OMEG -	12	$\pi^- p \rightarrow 3\pi p$
96 ± 9 25k	¹ DAUM	80C	SPEC -	63,94	$\pi^- p \rightarrow 3\pi p$
110 ±15 1097	¹ BALTAY	78B	HBC +0	15	$\pi^+ p \rightarrow p 4\pi$
112 ±18 1.6k	¹ EMMS	75	DBC 0	4	$\pi^+ n \rightarrow p(3\pi)^0$
122 ±14 1.2k	^{1,2} WAGNER	75	HBC 0	7	$\pi^+ p \rightarrow \Delta^{++}(3\pi)^0$
115 ±15	¹ ANTIPOV	73C	CNTR -	25,40	$\pi^- p \rightarrow p \eta \pi^-$
99 ±15 1580	CHALOUPKA	73	HBC -	3.9	$\pi^- p$
105 ± 5 28k	BOWEN	71	MMS -	5	$\pi^- p$
99 ± 5 24k	BOWEN	71	MMS +	5	$\pi^+ p$
103 ± 5 17k	BOWEN	71	MMS -	7	$\pi^- p$

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

117 ± 6 ±20 18k	³ SCHEGELSKY	06	RVUE 0	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	
120 ±40	CONDO	93	SHF	$\gamma p \rightarrow n \pi^+ \pi^+ \pi^-$	
115 ±14 490	BALTAY	78B	HBC 0	15	$\pi^+ p \rightarrow \Delta 3\pi$
72 ±16 5k	BINNIE	71	MMS -		$\pi^- p$ near a_2 threshold
79 ±12 941	ALSTON-...	70	HBC +	7.0	$\pi^+ p \rightarrow 3\pi p$

¹From a fit to $J^P = 2^+ \rho\pi$ partial wave.

²Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

³From analysis of L3 data at 183–209 GeV.

$K\bar{K}$ AND $\eta\pi$ MODES

VALUE (MeV) DOCUMENT ID

107 ±5 OUR ESTIMATE

110.4±1.7 OUR AVERAGE Includes data from the 2 datablocks that follow this one.

$K\bar{K}$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

109.8± 2.4 OUR AVERAGE

112 ±20 4700	^{1,2} CLELAND	82B	SPEC +	50	$\pi^+ p \rightarrow K_S^0 K^+ p$
120 ±25 5200	^{1,2} CLELAND	82B	SPEC -	50	$\pi^- p \rightarrow K_S^0 K^- p$
106 ± 4 4000	CHABAUD	80	SPEC -	17	$\pi^- A \rightarrow K_S^0 K^- A$
126 ±11 11000	CHABAUD	78	SPEC -	9.8	$\pi^- p \rightarrow K^- K_S^0 p$
101 ± 8 4730	CHABAUD	78	SPEC -	18.8	$\pi^- p \rightarrow K^- K_S^0 p$
113 ± 4	^{1,3} MARTIN	78D	SPEC -	10	$\pi^- p \rightarrow K_S^0 K^- p$
105 ± 8 2724	³ MARGULIE	76	SPEC -	23	$\pi^- p \rightarrow K^- K_S^0 p$
113 ±19 730	FOLEY	72	CNTR -	20.3	$\pi^- p \rightarrow K^- K_S^0 p$
123 ±13 1500	³ GRAYER	71	ASPK -	17.2	$\pi^- p \rightarrow K^- K_S^0 p$

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

120	± 15	870	⁴ SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121	± 51	1000	^{1,2} CLELAND	82B	SPEC	+	$30 \pi^+ p \rightarrow K_S^0 K^+ p$
110	± 18	350	HYAMS	78	ASPK	+	$12.7 \pi^+ p \rightarrow K^+ K_S^0 p$

¹ From a fit to $J^P = 2^+$ partial wave.

² Number of events evaluated by us.

³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

⁴ From analysis of L3 data at 91 and 183–209 GeV.

$\eta\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

111.1 \pm 2.4 OUR AVERAGE

115	± 20	BARBERIS	00H		450 $p p \rightarrow p_f \eta \pi^0 p_s$	
112	± 14	BARBERIS	00H		450 $p p \rightarrow \Delta_f^{++} \eta \pi^- p_s$	
112	$\pm 3 \pm 2$	¹ AMSLER	94D	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$	
103	$\pm 6 \pm 3$	BELADIDZE	93	VES	$37 \pi^- N \rightarrow \eta \pi^- N$	
112.2 \pm 5.7	2561	DELFOSSÉ	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$
116.6 \pm 7.7	1653	DELFOSSÉ	81	SPEC	-	$\pi^\pm p \rightarrow p \pi^\pm \eta$
108	± 9	KEY	73	OSPK	-	$6 \pi^- p \rightarrow p \pi^- \eta$

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

119	± 14	² ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
110	± 4	ANISOVICH	09	RVUE	$\bar{p} p, \pi N$
127	$\pm 2 \pm 2$	³ THOMPSON	97	MPS	$18 \pi^- p \rightarrow \eta \pi^- p$
118	± 10	ARMSTRONG	93C	E760	0 $\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
104	± 9	6200 ⁴ CONFORTO	73	OSPK	- $6 \pi^- p \rightarrow p \text{MM}^-$

¹ The systematic error of 2 MeV corresponds to the spread of solutions.

² ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.

³ Resolution is not unfolded.

⁴ Missing mass with enriched $\text{MMS} = \eta\pi^-, \eta = 2\gamma$.

$\eta'\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
119\pm25 OUR AVERAGE			
140 \pm 35 \pm 20	IVANOV	01	B852 $18 \pi^- p \rightarrow \eta' \pi^- p$
106 \pm 32	BELADIDZE	93	VES $37 \pi^- N \rightarrow \eta' \pi^- N$

$a_2(1320)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 3π	$(70.1 \pm 2.7) \%$	S=1.2
Γ_2 $\rho(770)\pi$		
Γ_3 $f_2(1270)\pi$		
Γ_4 $\rho(1450)\pi$		
Γ_5 $\eta\pi$	$(14.5 \pm 1.2) \%$	
Γ_6 $\omega\pi\pi$	$(10.6 \pm 3.2) \%$	S=1.3
Γ_7 $K\bar{K}$	$(4.9 \pm 0.8) \%$	
Γ_8 $\eta'(958)\pi$	$(5.5 \pm 0.9) \times 10^{-3}$	
Γ_9 $\pi^\pm\gamma$	$(2.91 \pm 0.27) \times 10^{-3}$	
Γ_{10} $\gamma\gamma$	$(9.4 \pm 0.7) \times 10^{-6}$	
Γ_{11} e^+e^-	$< 5 \times 10^{-9}$	CL=90%

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 18 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 9.3$ for 15 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_5	10		
x_6	-89	-46	
x_7	-1	-2	-24
	x_1	x_5	x_6

 $a_2(1320)$ PARTIAL WIDTHS **$\Gamma(\eta\pi)$ Γ_5**

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

18.5 ± 3.0	870	¹ SCHEGELSKY 06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$
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¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

 $\Gamma(K\bar{K})$ Γ_7

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

$7.0^{+2.0}_{-1.5}$	870	¹ SCHEGELSKY 06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$
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¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

$\Gamma(\pi^\pm \gamma)$

Γ_9

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
311 ± 25 OUR AVERAGE					
358 ± 6 ± 42		¹ ADOLPH 14	COMP	-	190 $\pi^- \text{Pb} \rightarrow \pi^+ \pi^- \pi^- \text{Pb}'$
284 ± 25 ± 25	7.1k	MOLCHANOV 01	SELX		600 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
295 ± 60		CIHANGIR 82	SPEC	+	200 $\pi^+ A$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
461 ± 110		² MAY 77	SPEC	±	9.7 γA
¹ Primakoff reaction using $a_2(1320) \rightarrow 3\pi$ branching ratio of 70.1%.					
² Assuming one-pion exchange.					

$\Gamma(\gamma\gamma)$

Γ_{10}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1.00 ± 0.06 OUR AVERAGE					
0.98 ± 0.05 ± 0.09		ACCIARRI 97T	L3		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
0.96 ± 0.03 ± 0.13		ALBRECHT 97B	ARG		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1.26 ± 0.26 ± 0.18	36	BARU 90	MD1		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1.00 ± 0.07 ± 0.15	415	BEHREND 90C	CELL	0	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1.03 ± 0.13 ± 0.21		BUTLER 90	MRK2		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1.01 ± 0.14 ± 0.22	85	OEST 90	JADE		$e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$
0.90 ± 0.27 ± 0.15	56	¹ ALTHOFF 86	TASS	0	$e^+ e^- \rightarrow e^+ e^- 3\pi$
1.14 ± 0.20 ± 0.26		² ANTREASYAN 86	CBAL	0	$e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$
1.06 ± 0.18 ± 0.19		BERGER 84C	PLUT	0	$e^+ e^- \rightarrow e^+ e^- 3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.81 ± 0.19 ^{+0.42} / _{-0.11}	35	¹ BEHREND 83B	CELL	0	$e^+ e^- \rightarrow e^+ e^- 3\pi$
0.77 ± 0.18 ± 0.27	22	² EDWARDS 82F	CBAL	0	$e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$
¹ From $\rho\pi$ decay mode.					
² From $\eta\pi^0$ decay mode.					

$\Gamma(e^+ e^-)$

Γ_{11}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 0.56	90	ACHASOV 00K	SND	$e^+ e^- \rightarrow \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 25	90	VOROBYEV 88	ND	$e^+ e^- \rightarrow \pi^0 \eta$

$a_2(1320) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(3\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_1 \Gamma_{10}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.65 ± 0.02 ± 0.02	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
¹ From analysis of L3 data at 183–209 GeV.				

$$\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \qquad \Gamma_5\Gamma_{10}/\Gamma$$

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

$0.145^{+0.097}_{-0.034}$	¹ UEHARA	09A	BELL $e^+e^- \rightarrow e^+e^-\eta\pi^0$
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¹From the D_2 -wave. The fraction of the D_0 -wave is $3.4^{+2.3}_{-1.1}\%$.

$$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \qquad \Gamma_7\Gamma_{10}/\Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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$0.126 \pm 0.007 \pm 0.028$	¹ ALBRECHT	90G	ARG $e^+e^- \rightarrow e^+e^-K^+K^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.081 \pm 0.006 \pm 0.027$	² ALBRECHT	90G	ARG $e^+e^- \rightarrow e^+e^-K^+K^-$
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¹Using an incoherent background.

²Using a coherent background.

$a_2(1320)$ BRANCHING RATIOS

$$[\Gamma(f_2(1270)\pi) + \Gamma(\rho(1450)\pi)]/\Gamma(\rho(770)\pi) \qquad (\Gamma_3+\Gamma_4)/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
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<0.12	90	ABRAMOVI...	70B	HBC	- 3.93 $\pi^- p$
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$$\Gamma(\eta\pi)/\Gamma(3\pi) \qquad \Gamma_5/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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0.207 ± 0.018 OUR FIT

0.213 ± 0.020 OUR AVERAGE

0.18 ± 0.05		FORINO	76	HBC	11 $\pi^- p$
0.22 ± 0.05	52	ANTIPOV	73	CNTR	- 40 $\pi^- p$
0.211 ± 0.044	149	CHALOUPKA	73	HBC	- 3.9 $\pi^- p$
0.246 ± 0.042	167	ALSTON-...	71	HBC	+ 7.0 $\pi^+ p$
0.25 ± 0.09	15	BOECKMANN	70	HBC	+ 5.0 $\pi^+ p$
0.23 ± 0.08	22	ASCOLI	68	HBC	- 5 $\pi^- p$
0.12 ± 0.08		CHUNG	68	HBC	- 3.2 $\pi^- p$
0.22 ± 0.09		CONTE	67	HBC	- 11.0 $\pi^- p$

$$\Gamma(\omega\pi\pi)/\Gamma(3\pi) \qquad \Gamma_6/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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0.15 ± 0.05 OUR FIT Error includes scale factor of 1.3.

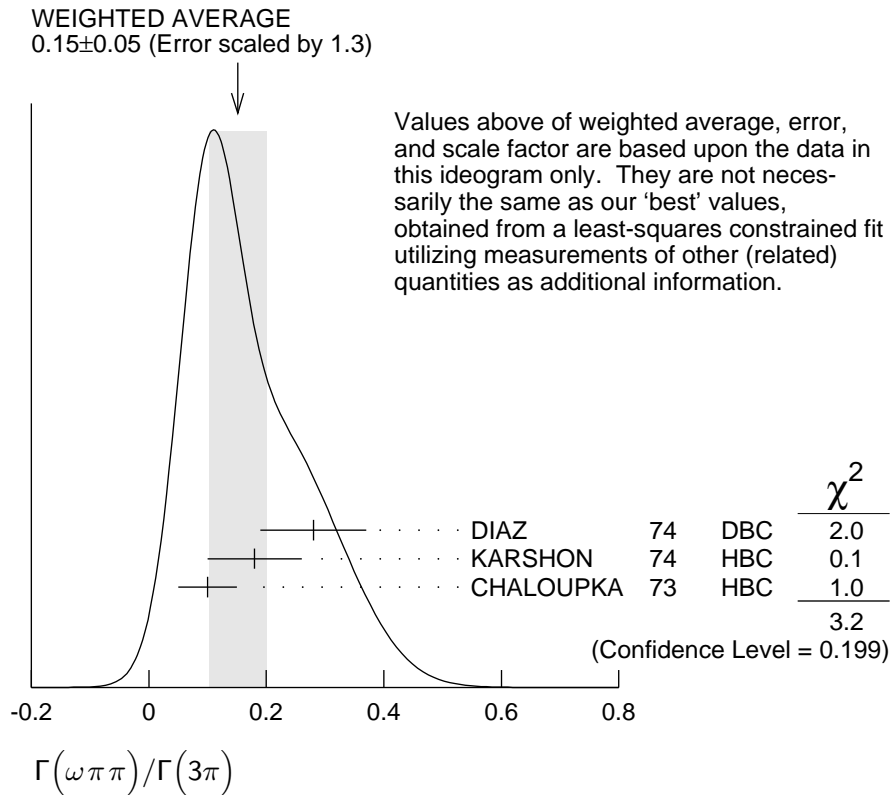
0.15 ± 0.05 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

0.28 ± 0.09	60	DIAZ	74	DBC	0 6 $\pi^+ n$
0.18 ± 0.08		¹ KARSHON	74	HBC	Avg. of above two
0.10 ± 0.05	279	² CHALOUPKA	73	HBC	- 3.9 $\pi^- p$

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

0.29 ± 0.08	140	¹ KARSHON	74	HBC	0 4.9 $\pi^+ p$
0.10 ± 0.04	60	¹ KARSHON	74	HBC	+ 4.9 $\pi^+ p$
0.19 ± 0.08		DEFOIX	73	HBC	0 0.7 $\bar{p}p$

- ¹ KARSHON 74 suggest an additional $I = 0$ state strongly coupled to $\omega\pi\pi$ which could explain discrepancies in branching ratios and masses. We use a central value and a systematic spread.
² Decays to $b_1(1040)\pi$, $b_1 \rightarrow \omega\pi$. Error increased to account for possible systematic errors of complicated analysis.



$\Gamma(K\bar{K})/\Gamma(3\pi)$

Γ_7/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.070 ± 0.012					OUR FIT
0.078 ± 0.017		CHABAUD	78	RVUE	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.011 ± 0.003		¹ BERTIN	98B	OBLX	$0.0 \bar{p}p \rightarrow K^\pm K_S \pi^\mp$
0.056 ± 0.014	50	² CHALOUPKA	73	HBC	$3.9 \pi^- p$
0.097 ± 0.018	113	² ALSTON-...	71	HBC	$7.0 \pi^+ p$
0.06 ± 0.03		² ABRAMOVI...	70B	HBC	$3.93 \pi^- p$
0.054 ± 0.022		² CHUNG	68	HBC	$3.2 \pi^- p$

- ¹ Using 4π data from BERTIN 97D.
² Included in CHABAUD 78 review.

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$

Γ_7/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.08 ± 0.02	¹ BERTIN	98B	OBLX $0.0 \bar{p}p \rightarrow K^\pm K_S \pi^\mp$
¹ Using $\eta\pi\pi$ data from AMSLER 94D.			

$\Gamma(\eta\pi)/[\Gamma(3\pi) + \Gamma(\eta\pi) + \Gamma(K\bar{K})]$ $\Gamma_5/(\Gamma_1+\Gamma_5+\Gamma_7)$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
0.162±0.012 OUR FIT					
0.140±0.028 OUR AVERAGE					
0.13 ±0.04		ESPIGAT	72	HBC	± 0.0 $\bar{p}p$
0.15 ±0.04	34	BARNHAM	71	HBC	+ 3.7 π^+p

$\Gamma(K\bar{K})/[\Gamma(3\pi) + \Gamma(\eta\pi) + \Gamma(K\bar{K})]$ $\Gamma_7/(\Gamma_1+\Gamma_5+\Gamma_7)$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
0.054±0.009 OUR FIT					
0.048±0.012 OUR AVERAGE					
0.05 ±0.02		TOET	73	HBC	+ 5 π^+p
0.09 ±0.04		TOET	73	HBC	0 5 π^+p
0.03 ±0.02	8	¹ DAMERI	72	HBC	- 11 π^-p
0.06 ±0.03	17	BARNHAM	71	HBC	+ 3.7 π^+p
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.020±0.004		² ESPIGAT	72	HBC	± 0.0 $\bar{p}p$

¹ Montanet agrees. Vlada.

² Not averaged because of discrepancy between masses from $K\bar{K}$ and $\rho\pi$ modes.

$\Gamma(\eta'(958)\pi)/\Gamma_{total}$ Γ_8/Γ

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.006	95	ALDE	92B	GAM2	38,100 $\pi^-p \rightarrow \eta'\pi^0n$
<0.02	97	BARNHAM	71	HBC	+ 3.7 π^+p
0.004±0.004		¹ BOESEBECK	68	HBC	+ 8 π^+p

¹ No longer valid since $\Gamma(K\bar{K})/\Gamma(3\pi)$ value has changed (MORRISON 71).

$\Gamma(\eta'(958)\pi)/\Gamma(3\pi)$ Γ_8/Γ_1

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.011	90	EISENSTEIN	73	HBC	- 5 π^-p
<0.04		ALSTON-...	71	HBC	+ 7.0 π^+p
0.04 $\begin{smallmatrix} +0.03 \\ -0.04 \end{smallmatrix}$		BOECKMANN	70	HBC	0 5.0 π^+p

$\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$ Γ_8/Γ_5

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.038±0.005 OUR AVERAGE			
0.05 ±0.02	ADOLPH	15	COMP 191 $\pi^-p \rightarrow \eta^{(\prime)}\pi^-p$
0.032±0.009	ABELE	97C	CBAR 0.0 $\bar{p}p \rightarrow \pi^0\pi^0\eta'$
0.047±0.010±0.004	¹ BELADIDZE	93	VES 37 $\pi^-N \rightarrow a_2^-N$
0.034±0.008±0.005	BELADIDZE	92	VES 36 $\pi^-C \rightarrow a_2^-C$

¹ Using $B(\eta' \rightarrow \pi^+\pi^-\eta) = 0.441$, $B(\eta \rightarrow \gamma\gamma) = 0.389$ and $B(\eta \rightarrow \pi^+\pi^-\pi^0) = 0.236$.

$\Gamma(\pi^\pm \gamma)/\Gamma_{\text{total}}$					Γ_9/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
$0.005^{+0.005}_{-0.003}$	¹ EISENBERG	72	HBC	4.3,5.25,7.5	γp

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

¹ Pion-exchange model used in this estimation.

$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$					Γ_{11}/Γ
VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT	
<6	90	ACHASOV	00K	SND	$e^+ e^- \rightarrow \pi^0 \pi^0$

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

$a_2(1320)$ REFERENCES

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ADOLPH	14	EPJ A50 79	C. Adolph <i>et al.</i>	(COMPASS Collab.)
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)
MOLCHANOV	01	PL B521 171	V.V. Molchanov <i>et al.</i>	(FNAL SELEX Collab.)
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	97C	PL B404 179	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)
AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
BELADIDZE	93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)
CONDO	93	PR D48 3045	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)
ALDE	92B	ZPHY C54 549	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
BELADIDZE	92	ZPHY C54 235	G.M. Beladidze <i>et al.</i>	(VES Collab.)
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)
BEHREND	90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
ALTHOFF	86	ZPHY C31 537	M. Althoff <i>et al.</i>	(TASSO Collab.)
ANTREASYAN	86	PR D33 1847	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
BERGER	84C	PL 149B 427	C. Berger <i>et al.</i>	(PLUTO Collab.)
BEHREND	83B	PL 125B 518 (erratum)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
CIHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
DELFOSSÉ	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
CHABAUD	80	NP B175 189	V. Chabaud <i>et al.</i>	(CERN, MPIM, AMST)
DAUM	80C	PL 89B 276	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)
CHABAUD	78	NP B145 349	V. Chabaud <i>et al.</i>	(CERN, MPIM)
FERRERSORIA	78	PL 74B 287	A. Ferrer Soria <i>et al.</i>	(ORSAY, CERN, CDEF+)

HYAMS	78	NP B146 303	B.D. Hyams <i>et al.</i>	(CERN, MPIM, ATEN)
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA) JP
MAY	77	PR D16 1983	E.N. May <i>et al.</i>	(ROCH, CORN)
FORINO	76	NC 35A 465	A. Forino <i>et al.</i>	(BGNA, FIRZ, GENO, MILA+)
MARGULIE	76	PR D14 667	M. Margulies <i>et al.</i>	(BNL, CUNY)
EMMS	75	PL 58B 117	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL) JP
WAGNER	75	PL 58B 201	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP
DIAZ	74	PRL 32 260	J. Diaz <i>et al.</i>	(CASE, CMU)
KARSHON	74	PRL 32 852	U. Karshon <i>et al.</i>	(REHO)
ANTIPOV	73	NP B63 175	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP
ANTIPOV	73C	NP B63 153	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP
CHALOUPKA	73	PL 44B 211	V. Chaloupka <i>et al.</i>	(CERN)
CONFORTO	73	PL 45B 154	G. Conforto <i>et al.</i>	(EFI, FNAL, TATO+)
DEFOIX	73	PL 43B 141	C. Defoix <i>et al.</i>	(CDEF)
EISENSTEIN	73	PR D7 278	L. Eisenstein <i>et al.</i>	(ILL)
KEY	73	PRL 30 503	A.W. Key <i>et al.</i>	(TATO, EFI, FNAL, WISC)
TOET	73	NP B63 248	D.Z. Toet <i>et al.</i>	(NIJM, BONN, DURH, TORI)
DAMERI	72	NC 9A 1	M. Dameri <i>et al.</i>	(GENO, MILA, SACL)
EISENBERG	72	PR D5 15	Y. Eisenberg <i>et al.</i>	(REHO, SLAC, TELA)
ESPIGAT	72	NP B36 93	P. Espigat <i>et al.</i>	(CERN, CDEF)
FOLEY	72	PR D6 747	K.J. Foley <i>et al.</i>	(BNL, CUNY)
ALSTON-...	71	PL 34B 156	M. Alston-Garnjost <i>et al.</i>	(LRL)
BARNHAM	71	PRL 26 1494	K.W.J. Barnham <i>et al.</i>	(LBL)
BINNIE	71	PL 36B 257	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)
BOWEN	71	PRL 26 1663	D.R. Bowen <i>et al.</i>	(NEAS, STON)
GRAYER	71	PL 34B 333	G. Grayer <i>et al.</i>	(CERN, MPIM)
ABRAMOVI...	70B	NP B23 466	M. Abramovich <i>et al.</i>	(CERN) JP
ALSTON-...	70	PL 33B 607	M. Alston-Garnjost <i>et al.</i>	(LRL)
BOECKMANN	70	NP B16 221	K. Boeckmann <i>et al.</i>	(BONN, DURH, NIJM+)
ASCOLI	68	PRL 20 1321	G. Ascoli <i>et al.</i>	(ILL) JP
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)
CHUNG	68	PR 165 1491	S.U. Chung <i>et al.</i>	(LRL)
CONTE	67	NC 51A 175	F. Conte <i>et al.</i>	(GENO, HAMB, MILA, SACL)