$a_2(1320)$

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

$a_2(1320)$ T-MATRIX POLE $\sqrt{s}$

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

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
(1305–1321)−i(52–58) OUR ESTIMATE				
$(1318.7 \pm 1.9 \pm 1.3)-i(53.8 \pm 2.3^{+1.7}_{-0.9})$	[1] KOPF	21	RVUE	0.9 $p\overline{p} \to \pi^0\pi^0\eta$, $\pi^0\eta\eta$, $\pi^0 K^+ K^-$ and 191 $\pi^- p \to \pi^-\pi^-\pi^+ p$
$(1312.5 \pm 0.7 \pm 2.6)-i(53.5 \pm 0.6 \pm 1.9)$	[2] ALBRECHT	20	RVUE	0.9 $\overline{p}p \to \pi^0\pi^0\eta$, $\pi^0\eta\eta$, $\pi^0 K^+ K^-$
$(1306.0 \pm 0.8 \pm 1.3)-i(57.2 \pm 0.8 \pm 0.0)$	[3] RODAS	19	RVUE	91 $\pi^- p \to \eta^{(\prime)}\pi^- p$
$(1309 \pm 4) - i\ (55 \pm 2)$	[4] ANISOVICH	09	RVUE	$\overline{p}p$, πN

[1] Extraction based on a combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi$, $\eta'\pi$ and $K\overline{K}$ systems.

[2] T-matrix pole with 2 poles, 2 channels ($\pi^0\eta$ and $K\overline{K}$).

[3] Coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15 data. Supersedes JACKURA 18. Performed by JPAC.

[4] Amplitude did not include dispersive corrections. From analysis of $\eta\pi$ mode.

$a_2(1320)$ MASS

VALUE (MeV)	DOCUMENT ID
1318.2±0.6 OUR AVERAGE Includes data from the 4 datablocks that follow this one. Error includes scale factor of 1.2.	

3π MODE

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

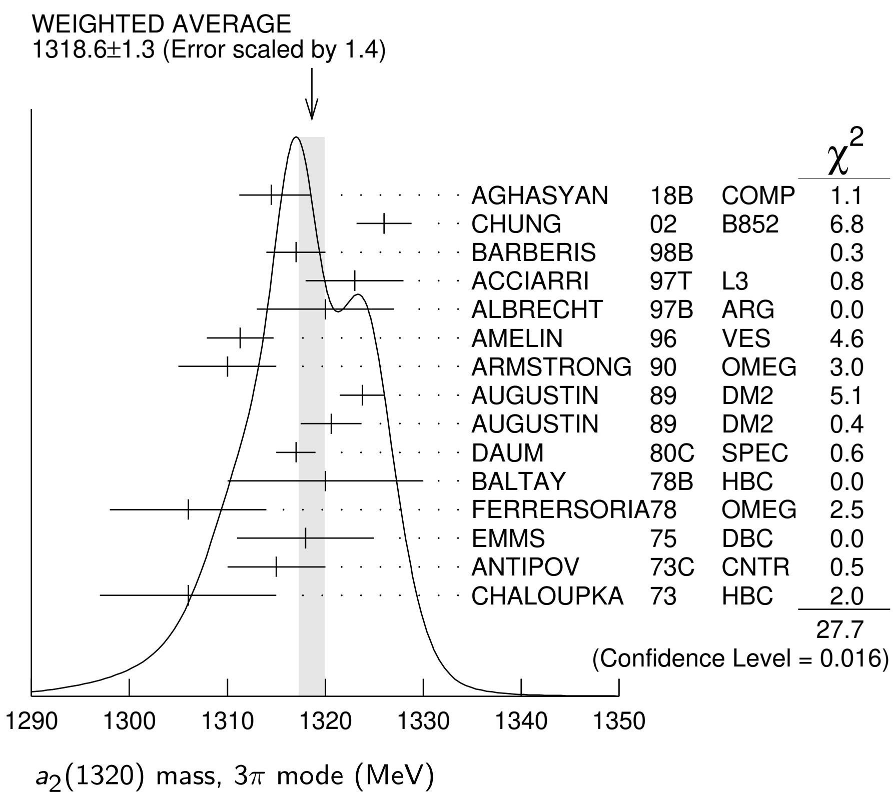
VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
1318.6± 1.3 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.						
$1314.5^{+4.0}_{-3.3}$	46M	[1] AGHASYAN	18B	COMP		190 $\pi^- p \to \pi^-\pi^+\pi^- p$
1326 ± 2 ±2		CHUNG	02	B852		18.3 $\pi^- p \to \pi^+\pi^-\pi^- p$
1317 ± 3		BARBERIS	98B			450 $pp \to p_f \pi^+\pi^-\pi^0 p_s$
1323 ± 4 ±3		ACCIARRI	97T	L3		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
1320 ± 7		ALBRECHT	97B	ARG		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
1311.3± 1.6±3.0	72.4k	AMELIN	96	VES		36 $\pi^- p \to \pi^+\pi^-\pi^0 n$
1310 ± 5		ARMSTRONG	90	OMEG	0	300.0$pp \to pp\pi^+\pi^-\pi^0$

1323.8 $\pm$ 2.3		4022	AUGUSTIN	89	DM2	$\pm$	$J/\psi \to \rho^{\pm} a_2^{\mp}$
1320.6 $\pm$ 3.1		3562	AUGUSTIN	89	DM2	0	$J/\psi \to \rho^0 a_2^0$
1317 $\pm$ 2		25k	[2] DAUM	80C	SPEC	$-$	63,94 $\pi^- p \to 3\pi p$
1320 $\pm$10		1097	[2] BALTAY	78B	HBC	$+0$	15 $\pi^+ p \to p 4\pi$
1306 $\pm$ 8			FERRERSORIA	78	OMEG	$-$	9 $\pi^- p \to p 3\pi$
1318 $\pm$ 7		1.6k	[2] EMMS	75	DBC	0	4 $\pi^+ n \to p(3\pi)^0$
1315 $\pm$ 5			[2] ANTIPOV	73C	CNTR	$-$	25,40 $\pi^- p \to p \eta \pi^-$
1306 $\pm$ 9		1580	CHALOUPKA	73	HBC	$-$	3.9 $\pi^- p$

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

1321 $\pm$ 1	${}^{+0}_{-7}$	420k	[3] ALEKSEEV	10	COMP		190 $\pi^- Pb \to \pi^- \pi^- \pi^+ Pb'$
1300 $\pm$ 2	$\pm$4	18k	[4] SCHEGELSKY	06	RVUE	0	$\gamma\gamma \to \pi^+ \pi^- \pi^0$
1305 $\pm$14			CONDO	93	SHF		$\gamma p \to n \pi^+ \pi^+ \pi^-$
1310 $\pm$ 2			[2] EVANGELIS...	81	OMEG	$-$	12 $\pi^- p \to 3\pi p$
1343 $\pm$11		490	BALTAY	78B	HBC	0	15 $\pi^+ p \to \Delta 3\pi$
1309 $\pm$ 5		5k	BINNIE	71	MMS	$-$	$\pi^- p$ near a_2 threshold
1299 $\pm$ 6		28k	BOWEN	71	MMS	$-$	5 $\pi^- p$
1300 $\pm$ 6		24k	BOWEN	71	MMS	$+$	5 $\pi^+ p$
1309 $\pm$ 4		17k	BOWEN	71	MMS	$-$	7 $\pi^- p$
1306 $\pm$ 4		941	ALSTON-...	70	HBC	$+$	7.0 $\pi^+ p \to 3\pi p$

[1] Statistical error negligible.
[2] From a fit to $J^P = 2^+ \rho\pi$ partial wave.
[3] Superseded by AGHASYAN 2018B.
[4] From analysis of L3 data at 183–209 GeV.



$K\overline{K}$ 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 $\pi^+ p \to K^0_S K^+ p$
1324 ± 6	5200	[1,2] CLELAND 82B	SPEC	−	50 $\pi^- p \to K^0_S K^- p$
1320 ± 2	4000	CHABAUD 80	SPEC	−	17 π^- A $\to K^0_S K^-$ A
1312 ± 4	11000	CHABAUD 78	SPEC	−	9.8 $\pi^- p \to K^- K^0_S p$
1316 ± 2	4730	CHABAUD 78	SPEC	−	18.8 $\pi^- p \to K^- K^0_S p$
1318 ± 1		[1,3] MARTIN 78D	SPEC	−	10 $\pi^- p \to K^0_S K^- p$
1320 ± 2	2724	MARGULIE 76	SPEC	−	23 $\pi^- p \to K^- K^0_S p$
1313 ± 4	730	FOLEY 72	CNTR	−	20.3 $\pi^- p \to K^- K^0_S p$
1319 ± 3	1500	[3] GRAYER 71	ASPK	−	17.2 $\pi^- p \to K^- K^0_S p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1304 ±10	870	[4] SCHEGELSKY 06A	RVUE	0	$\gamma\gamma \to K^0_S K^0_S$
1330 ±11	1000	[1,2] CLELAND 82B	SPEC	+	30 $\pi^+ p \to K^0_S K^+ p$
1324 ± 5	350	HYAMS 78	ASPK	+	12.7 $\pi^+ p \to K^+ K^0_S p$

[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
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 $p p \to p_f \eta \pi^0 p_s$
1316 ± 9		BARBERIS 00H			450 $p p \to \Delta^{++}_f \eta \pi^- p_s$
1317 ± 1 ±2		THOMPSON 97	MPS		18 $\pi^- p \to \eta \pi^- p$
1315 ± 5 ±2		[1] AMSLER 94D	CBAR		0.0 $\overline{p} p \to \pi^0 \pi^0 \eta$
1325.1± 5.1		AOYAGI 93	BKEI		$\pi^- p \to \eta \pi^- p$
1317.7± 1.4±2.0		BELADIDZE 93	VES		37$\pi^- N \to \eta \pi^- N$
1323 ± 8	1000	[2] KEY 73	OSPK	−	6 $\pi^- p \to p \pi^- \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1307 ± 1 ±6		[3] JACKURA 18	RVUE		$\pi^- p \to \eta \pi^- p$
1315 ±12		[4] ADOLPH 15	COMP		191 $\pi^- p \to \eta^{(\prime)} \pi^- p$
1324 ± 5		ARMSTRONG 93C	E760	0	$\overline{p} p \to \pi^0 \eta \eta \to 6\gamma$
1336.2± 1.7	2561	DELFOSSE 81	SPEC	+	$\pi^\pm p \to p \pi^\pm \eta$
1330.7± 2.4	1653	DELFOSSE 81	SPEC	−	$\pi^\pm p \to p \pi^\pm \eta$
1324 ± 8	6200	[2,5] CONFORTO 73	OSPK	−	6 $\pi^- p \to p \mathrm{MM}^-$

[1] The systematic error of 2 MeV corresponds to the spread of solutions.
[2] Error includes 5 MeV systematic mass-scale error.
[3] Superseded by RODAS 19.
[4] ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.
[5] Missing mass with enriched MMS $= \eta\pi^-$, $\eta = 2\gamma$.

$\eta' \pi$ MODE

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.				
1322 ± 7 OUR AVERAGE				
1318 ± 8 $^{+3}_{-5}$	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

VALUE (MeV)	DOCUMENT ID
107 ±5 OUR ESTIMATE	
107.8±1.2 OUR AVERAGE	Includes data from the 4 datablocks that follow this one.

3π MODE

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
The data in this block is included in the average printed for a previous datablock.						
105.0$^{+1.7}_{-1.9}$ OUR AVERAGE						
106.6$^{+3.4}_{-7.0}$	46M	[1] AGHASYAN	18B	COMP		190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
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$p p \rightarrow p p \pi^+ \pi^- \pi^0$
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		[2] EVANGELIS...	81	OMEG	−	12 $\pi^- p \rightarrow 3\pi p$
96 ± 9	25k	[2] DAUM	80C	SPEC	−	63,94 $\pi^- p \rightarrow 3\pi p$
110 ±15	1097	[2] BALTAY	78B	HBC	+0	15 $\pi^+ p \rightarrow p 4\pi$
112 ±18	1.6k	[2] EMMS	75	DBC	0	4 $\pi^+ n \rightarrow p (3\pi)^0$
122 ±14	1.2k	[2,3] WAGNER	75	HBC	0	7 $\pi^+ p \rightarrow \Delta^{++} (3\pi)^0$
115 ±15		[2] 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. • • •						
110 ± 2 $^{+2}_{-15}$	420k	[4] ALEKSEEV	10	COMP		190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$

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

[1] Statistical error negligible.
[2] From a fit to $J^P = 2^+$ $\rho\pi$ partial wave.
[3] Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
[4] Superseded by AGHASYAN 2018B.
[5] From analysis of L3 data at 183–209 GeV.

$K\overline{K}$ 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 $\pi^+ p \to K^0_S K^+ p$
120 ±25	5200	[1,2] CLELAND	82B	SPEC	−	50 $\pi^- p \to K^0_S K^- p$
106 ± 4	4000	CHABAUD	80	SPEC	−	17 $\pi^- A \to K^0_S K^- A$
126 ±11	11000	CHABAUD	78	SPEC	−	9.8 $\pi^- p \to K^- K^0_S p$
101 ± 8	4730	CHABAUD	78	SPEC	−	18.8 $\pi^- p \to K^- K^0_S p$
113 ± 4		[1,3] MARTIN	78D	SPEC	−	10 $\pi^- p \to K^0_S K^- p$
105 ± 8	2724	[3] MARGULIE	76	SPEC	−	23 $\pi^- p \to K^- K^0_S p$
113 ±19	730	FOLEY	72	CNTR	−	20.3 $\pi^- p \to K^- K^0_S p$
123 ±13	1500	[3] GRAYER	71	ASPK	−	17.2 $\pi^- p \to K^- K^0_S p$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
120 ±15	870	[4] SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \to K^0_S K^0_S$
121 ±51	1000	[1,2] CLELAND	82B	SPEC	+	30 $\pi^+ p \to K^0_S K^+ p$
110 ±18	350	HYAMS	78	ASPK	+	12.7 $\pi^+ p \to K^+ K^0_S p$

[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
The data in this block is included in the average printed for a previous datablock.						
111.1± 2.4 OUR AVERAGE						
115 ±20		BARBERIS	00H			450 $pp \to p_f \eta\pi^0 p_s$
112 ±14		BARBERIS	00H			450 $pp \to \Delta^{++}_f \eta\pi^- p_s$
112 ± 3 ±2		[1] AMSLER	94D	CBAR		0.0 $\overline{p}p \to \pi^0\pi^0\eta$
103 ± 6 ±3		BELADIDZE	93	VES		37$\pi^- N \to \eta\pi^- N$
112.2± 5.7	2561	DELFOSSE	81	SPEC	+	$\pi^\pm p \to p\pi^\pm\eta$
116.6± 7.7	1653	DELFOSSE	81	SPEC	−	$\pi^\pm p \to p\pi^\pm\eta$
108 ± 9	1000	KEY	73	OSPK	−	6 $\pi^- p \to p\pi^-\eta$

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

112 $\pm$ 1 $\pm$8		[2] JACKURA	18	RVUE		$\pi^- p \to \eta\pi^- p$
119 $\pm$14		[3] ADOLPH	15	COMP		191 $\pi^- p \to \eta^{(\prime)}\pi^- p$
127 $\pm$ 2 $\pm$2		[4] THOMPSON	97	MPS		18 $\pi^- p \to \eta\pi^- p$
118 $\pm$10		ARMSTRONG	93C	E760	0	$\overline{p}p \to \pi^0\eta\eta \to 6\gamma$
104 $\pm$ 9	6200	[5] CONFORTO	73	OSPK	$-$	6 $\pi^- p \to p\text{MM}^-$

[1] The systematic error of 2 MeV corresponds to the spread of solutions.
[2] Superseded by RODAS 19.
[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] Resolution is not unfolded.
[5] Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$.

$\eta'\pi$ MODE

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
The data in this block is included in the average printed for a previous datablock.				
119±25 OUR AVERAGE				
140±35±20	IVANOV	01	B852	18 $\pi^- p \to \eta'\pi^- p$
106±32	BELADIDZE	93	VES	37$\pi^- N \to \eta'\pi^- N$

$a_2(1320)$ 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	$K\overline{K}$	(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 $\left\langle\delta x_i \delta x_j\right\rangle/(\delta x_i\cdot\delta x_j)$, 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
• • • We do not use the following data for averages, fits, limits, etc. • • •						
18.5±3.0	870	[1] SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \to K^0_S K^0_S$

[1] From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \to \gamma\gamma) = 0.91$ keV and SU(3) relations.

$\Gamma(K\overline{K})$ Γ_7

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$7.0^{+2.0}_{-1.5}$	870	[1] SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \to K^0_S K^0_S$

[1] From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \to \gamma\gamma) = 0.91$ 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 π^- Pb → $\pi^+\pi^-\pi^-$ Pb′
284± 25±25	7.1k	MOLCHANOV	01	SELX		600 $\pi^- A \to \pi^+\pi^-\pi^- A$
295± 60		CIHANGIR	82	SPEC	+	200 π^+ A
• • • We do not use the following data for averages, fits, limits, etc. • • •						
461±110		[2] MAY	77	SPEC	±	9.7 γ A

[1] Primakoff reaction using $a_2(1320) \to 3\pi$ 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		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
0.96±0.03±0.13		ALBRECHT	97B	ARG		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
1.26±0.26±0.18	36	BARU	90	MD1		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
1.00±0.07±0.15	415	BEHREND	90C	CELL	0	$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
1.03±0.13±0.21		BUTLER	90	MRK2		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
1.01±0.14±0.22	85	OEST	90	JADE		$e^+e^- \to e^+e^-\pi^0\eta$
0.90±0.27±0.15	56	[1] ALTHOFF	86	TASS	0	$e^+e^- \to e^+e^- 3\pi$
1.14±0.20±0.26		[2] ANTREASYAN	86	CBAL	0	$e^+e^- \to e^+e^-\pi^0\eta$

$1.06 \pm 0.18 \pm 0.19$		BERGER	84C	PLUT	0	$e^+ e^- \to e^+ e^- 3\pi$

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

$0.81 \pm 0.19^{+0.42}_{-0.11}$	35	[1] BEHREND	82C	CELL	0	$e^+ e^- \to e^+ e^- 3\pi$
$0.77 \pm 0.18 \pm 0.27$	22	[2] EDWARDS	82F	CBAL	0	$e^+ e^- \to e^+ e^- \pi^0 \eta$

[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	$e^+ e^- \to \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<25	90	VOROBYEV	88	ND	$e^+ e^- \to \pi^0 \eta$

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

$\Gamma(3\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ — $\Gamma_1\Gamma_{10}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.65 \pm 0.02 \pm 0.02$	18k	[1] SCHEGELSKY	06	RVUE	$\gamma\gamma \to \pi^+ \pi^- \pi^0$

[1] From analysis of L3 data at 183–209 GeV.

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

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.145^{+0.097}_{-0.034}$	[1] UEHARA	09A	BELL	$e^+ e^- \to e^+ e^- \eta \pi^0$

[1] From the D_2-wave. The fraction of the D_0-wave is $3.4^{+2.3}_{-1.1}$%.

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

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
$0.126 \pm 0.007 \pm 0.028$	[1] ALBRECHT	90G	ARG	$e^+ e^- \to e^+ e^- K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.081 \pm 0.006 \pm 0.027$	[2] ALBRECHT	90G	ARG	$e^+ e^- \to e^+ e^- K^+ K^-$

[1] Using an incoherent background.
[2] Using a coherent background.

$a_2(1320)$ BRANCHING RATIOS

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

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
<0.12	90	ABRAMOVI...	70B	HBC	−	3.93 $\pi^- p$

$\Gamma(\rho(770)\pi)/\Gamma(f_2(1270)\pi)$ — Γ_2/Γ_3

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$16.5^{+1.2}_{-2.4}$	46M	[1] AGHASYAN	18B	COMP	190 $\pi^- p \to \pi^- \pi^+ \pi^- p$

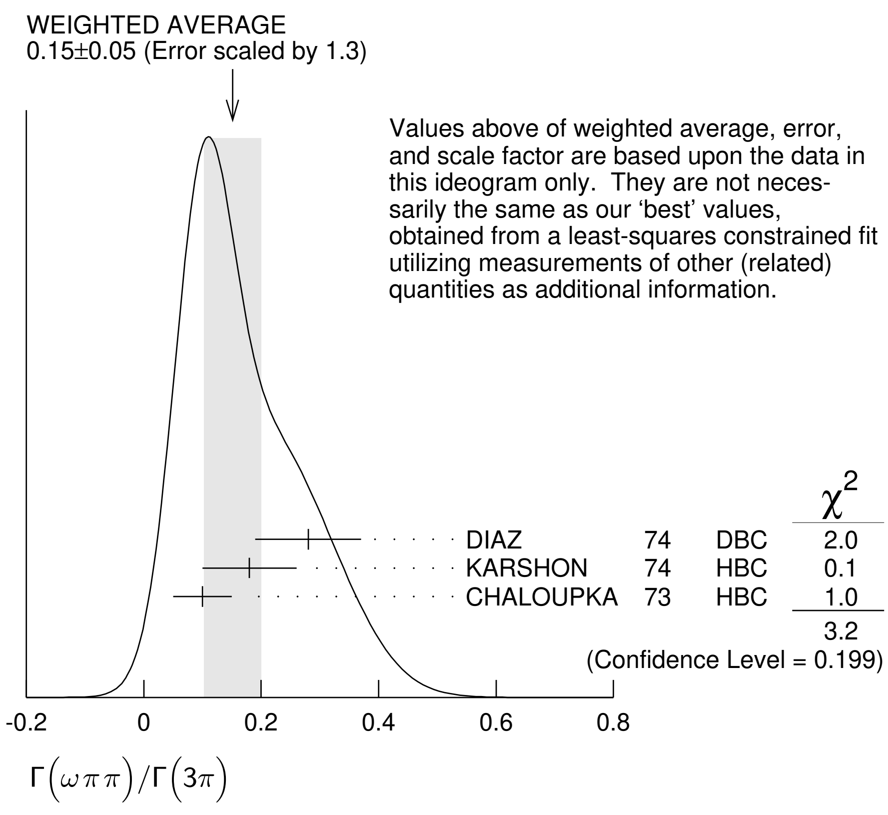
[1] Statistical error negligible.

$\Gamma(\eta\pi)/\Gamma(3\pi)$ Γ_5/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
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 $\pi^- p$

$\Gamma(\omega\pi\pi)/\Gamma(3\pi)$ Γ_6/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
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 $b_1(1040)\pi$, $b_1 \to \omega\pi$. Error increased to account for possible systematic errors of complicated analysis.

$\Gamma(K\overline{K})/\Gamma(3\pi)$ 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 $\overline{p}p \to K^{\pm}K_s\pi^{\mp}$
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.

$\Gamma(K\overline{K})/\Gamma(\eta\pi)$ Γ_7/Γ_5

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.31 ±0.22 $^{+0.09}_{-0.11}$	[1] KOPF	21	RVUE	0.9 $p\overline{p} \to \pi^0\pi^0\eta$, $\pi^0\eta\eta$, $\pi^0 K^+K^-$ and 191 $\pi^- p \to \pi^-\pi^-\pi^+ p$
0.352±0.011±0.175	[2] ALBRECHT	20	RVUE	0.9 $\overline{p}p \to \pi^0\pi^0\eta$, $\pi^0\eta\eta$, $\pi^0 K^+K^-$
0.08 ±0.02	[3] BERTIN	98B	OBLX	0.0 $\overline{p}p \to K^{\pm}K_s\pi^{\mp}$

[1] From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi$, $\eta'\pi$ and $K\overline{K}$ systems.
[2] Residues from T-matrix pole with 2 poles, 2 channels ($\pi^0\eta$ and $K\overline{K}$).
[3] Using $\eta\pi\pi$ data from AMSLER 94D.

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

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

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

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

[1] Montanet agrees. Vlada.
[2] Not averaged because of discrepancy between masses from $K\overline{K}$ and $\rho\pi$ modes.

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

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

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

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

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.011	90	EISENSTEIN	73	HBC	−	5 $\pi^- p$
<0.04		ALSTON-...	71	HBC	+	7.0 $\pi^+ p$
$0.04\ ^{+0.03}_{-0.04}$		BOECKMANN	70	HBC	0	5.0 $\pi^+ p$

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

VALUE	DOCUMENT ID		TECN	COMMENT
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 $\overline{p} p \rightarrow \pi^0 \pi^0 \eta'$
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	$36 \pi^- C \rightarrow a_2^- C$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.046\pm0.015^{+0.07}_{-0.006}$	[2] KOPF	21	RVUE	0.9 $p\overline{p} \rightarrow \pi^0\pi^0\eta$, $\pi^0\eta\eta$, $\pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow \pi^-\pi^-\pi^+ p$

[1] Using $B(\eta' \rightarrow \pi^+\pi^-\eta) = 0.441$, $B(\eta \rightarrow \gamma\gamma) = 0.389$ and $B(\eta \rightarrow \pi^+\pi^-\pi^0) = 0.236$.
[2] From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi$, $\eta'\pi$ and $K\overline{K}$ systems.

$\Gamma(\pi^\pm\gamma)/\Gamma_{total}$ — Γ_9/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.005^{+0.005}_{-0.003}$	[1] EISENBERG	72	HBC	4.3,5.25,7.5 γp

[1] Pion-exchange model used in this estimation.

$\Gamma(e^+e^-)/\Gamma_{total}$ — Γ_{11}/Γ

VALUE (units 10^{-9})	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6	90	ACHASOV	00K	SND	$e^+e^- \rightarrow \pi^0\pi^0$

$a_2(1320)$ REFERENCES

KOPF	21	EPJ C81 1056	B. Kopf *et al.*	(BOCH)	
ALBRECHT	20	EPJ C80 453	M. Albrecht *et al.*	(Crystal Barrel Collab.)	
RODAS	19	PRL 122 042002	A. Rodas *et al.*	(JPAC Collab.)	
AGHASYAN	18B	PR D98 092003	M. Aghasyan *et al.*	(COMPASS Collab.)	
JACKURA	18	PL B779 464	A. Jackura *et al.*	(JPAC and COMPASS Collab.)	
ADOLPH	15	PL B740 303	M. Adolph *et al.*	(COMPASS Collab.)	
ADOLPH	14	EPJ A50 79	C. Adolph *et al.*	(COMPASS Collab.)	
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev *et al.*	(COMPASS Collab.)	
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	
UEHARA	09A	PR D80 032001	S. Uehara *et al.*	(BELLE Collab.)	
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky *et al.*		
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky *et al.*		
CHUNG	02	PR D65 072001	S.U. Chung *et al.*	(BNL E852 Collab.)	
IVANOV	01	PRL 86 3977	E.I. Ivanov *et al.*	(BNL E852 Collab.)	
MOLCHANOV	01	PL B521 171	V.V. Molchanov *et al.*	(FNAL SELEX Collab.)	
ACHASOV	00K	PL B492 8	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)	
BARBERIS	00H	PL B488 225	D. Barberis *et al.*	(WA 102 Collab.)	
BARBERIS	98B	PL B422 399	D. Barberis *et al.*	(WA 102 Collab.)	
BERTIN	98B	PL B434 180	A. Bertin *et al.*	(OBELIX Collab.)	
ABELE	97C	PL B404 179	A. Abele *et al.*	(Crystal Barrel Collab.)	
ACCIARRI	97T	PL B413 147	M. Acciarri *et al.*	(L3 Collab.)	
ALBRECHT	97B	ZPHY C74 469	H. Albrecht *et al.*	(ARGUS Collab.)	
THOMPSON	97	PRL 79 1630	D.R. Thompson *et al.*	(BNL E852 Collab.)	
AMELIN	96	ZPHY C70 71	D.V. Amelin *et al.*	(SERP, TBIL)	
AMSLER	94D	PL B333 277	C. Amsler *et al.*	(Crystal Barrel Collab.)	
AOYAGI	93	PL B314 246	H. Aoyagi *et al.*	(BKEI Collab.)	
ARMSTRONG	93C	PL B307 394	T.A. Armstrong *et al.*	(FNAL, FERR, GENO+)	
BELADIDZE	93	PL B313 276	G.M. Beladidze *et al.*	(VES Collab.)	
CONDO	93	PR D48 3045	G.T. Condo *et al.*	(SLAC Hybrid Collab.)	
ALDE	92B	ZPHY C54 549	D.M. Alde *et al.*	(SERP, BELG, LANL, LAPP+)	
BELADIDZE	92	ZPHY C54 235	G.M. Beladidze *et al.*	(VES Collab.)	
ALBRECHT	90G	ZPHY C48 183	H. Albrecht *et al.*	(ARGUS Collab.)	
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)	
BARU	90	ZPHY C48 581	S.E. Baru *et al.*	(MD-1 Collab.)	
BEHREND	90C	ZPHY C46 583	H.J. Behrend *et al.*	(CELLO Collab.)	
BUTLER	90	PR D42 1368	F. Butler *et al.*	(Mark II Collab.)	
OEST	90	ZPHY C47 343	T. Oest *et al.*	(JADE Collab.)	
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev *et al.*	(NOVO)	
		Translated from YAF 48 436.			
ALTHOFF	86	ZPHY C31 537	M. Althoff *et al.*	(TASSO Collab.)	
ANTREASYAN	86	PR D33 1847	D. Antreasyan *et al.*	(Crystal Ball Collab.)	
BERGER	84C	PL 149B 427	C. Berger *et al.*	(PLUTO Collab.)	
BEHREND	82C	PL 114B 378	H.J. Behrend *et al.*	(CELLO Collab.)	
Also		PL 125B 518 (errat.)	H.J. Behrend *et al.*	(CELLO Collab.)	
CIHANGIR	82	PL 117B 123	S. Cihangir *et al.*	(FNAL, MINN, ROCH)	
CLELAND	82B	NP B208 228	W.E. Cleland *et al.*	(DURH, GEVA, LAUS+)	
EDWARDS	82F	PL 110B 82	C. Edwards *et al.*	(CIT, HARV, PRIN+)	
DELFOSSE	81	NP B183 349	A. Delfosse *et al.*	(GEVA, LAUS)	
EVANGELIS...	81	NP B178 197	C. Evangelista *et al.*	(BARI, BONN, CERN+)	
CHABAUD	80	NP B175 189	V. Chabaud *et al.*	(CERN, MPIM, AMST)	
DAUM	80C	PL 89B 276	C. Daum *et al.*	(AMST, CERN, CRAC, MPIM+)	JP
BALTAY	78B	PR D17 62	C. Baltay *et al.*	(COLU, BING)	
CHABAUD	78	NP B145 349	V. Chabaud *et al.*	(CERN, MPIM)	
FERRERSORIA	78	PL 74B 287	A. Ferrer Soria *et al.*	(ORSAY, CERN, CDEF+)	
HYAMS	78	NP B146 303	B.D. Hyams *et al.*	(CERN, MPIM, ATEN)	
MARTIN	78D	PL 74B 417	A.D. Martin *et al.*	(DURH, GEVA)	JP
MAY	77	PR D16 1983	E.N. May *et al.*	(ROCH, CORN)	
FORINO	76	NC 35A 465	A. Forino *et al.*	(BGNA, FIRZ, GENO, MILA+)	
MARGULIE	76	PR D14 667	M. Margulies *et al.*	(BNL, CUNY)	
EMMS	75	PL 58B 117	M.J. Emms *et al.*	(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 *et al.*	(CASE, CMU)	
KARSHON	74	PRL 32 852	U. Karshon *et al.*	(REHO)	
ANTIPOV	73	NP B63 175	Y.M. Antipov *et al.*	(CERN, SERP)	JP
ANTIPOV	73C	NP B63 153	Y.M. Antipov *et al.*	(CERN, SERP)	JP
CHALOUPKA	73	PL 44B 211	V. Chaloupka *et al.*	(CERN)	
CONFORTO	73	PL 45B 154	G. Conforto *et al.*	(EFI, FNAL, TNTO+)	
DEFOIX	73	PL 43B 141	C. Defoix *et al.*	(CDEF)	

EISENSTEIN	73	PR D7 278	L. Eisenstein *et al.*	(ILL)
KEY	73	PRL 30 503	A.W. Key *et al.*	(TNTO, EFI, FNAL, WISC)
TOET	73	NP B63 248	D.Z. Toet *et al.*	(NIJM, BONN, DURH, TORI)
DAMERI	72	NC 9A 1	M. Dameri *et al.*	(GENO, MILA, SACL)
EISENBERG	72	PR D5 15	Y. Eisenberg *et al.*	(REHO, SLAC, TELA)
ESPIGAT	72	NP B36 93	P. Espigat *et al.*	(CERN, CDEF)
FOLEY	72	PR D6 747	K.J. Foley *et al.*	(BNL, CUNY)
ALSTON-...	71	PL 34B 156	M. Alston-Garnjost *et al.*	(LRL)
BARNHAM	71	PRL 26 1494	K.W.J. Barnham *et al.*	(LBL)
BINNIE	71	PL 36B 257	D.M. Binnie *et al.*	(LOIC, SHMP)
BOWEN	71	PRL 26 1663	D.R. Bowen *et al.*	(NEAS, STON)
GRAYER	71	PL 34B 333	G. Grayer *et al.*	(CERN, MPIM)
ABRAMOVI...	70B	NP B23 466	M. Abramovich *et al.*	(CERN) JP
ALSTON-...	70	PL 33B 607	M. Alston-Garnjost *et al.*	(LRL)
BOECKMANN	70	NP B16 221	K. Boeckmann *et al.*	(BONN, DURH, NIJM+)
ASCOLI	68	PRL 20 1321	G. Ascoli *et al.*	(ILL) JP
BOESEBECK	68	NP B4 501	K. Boesebeck *et al.*	(AACH, BERL, CERN)
CHUNG	68	PR 165 1491	S.U. Chung *et al.*	(LRL)
CONTE	67	NC 51A 175	F. Conte *et al.*	(GENO, HAMB, MILA, SACL)