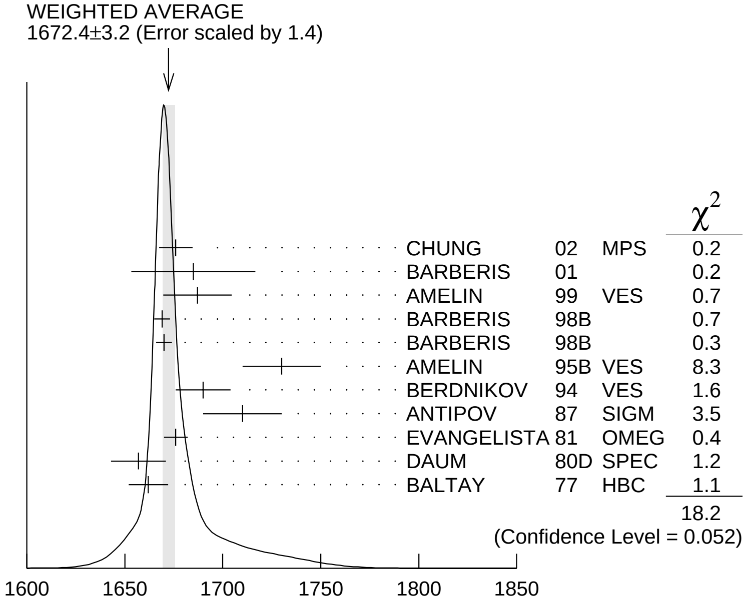
$\pi_2(1670)$

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

$\pi_2(1670)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1670 ±20 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.					
1672.4± 3.2 OUR NEW AVERAGE Error includes scale factor of 1.4. See the ideogram below. [1672.1 ± 3.5 MeV OUR 2002 AVERAGE Scale factor = 1.5]					
1676 ± 3 ± 8		[1] CHUNG 02	MPS		18.3 $\pi^- p \to \pi^+\pi^-\pi^- p$
1685 ±10 ±30		[2] BARBERIS 01			450 $pp \to p_f 3\pi^0 p_s$
1687 ± 9 ±15		AMELIN 99	VES		37 $\pi^- A \to \omega\pi^-\pi^0 A^*$
1669 ± 4		BARBERIS 98B			450 $pp \to p_f \rho\pi p_s$
1670 ± 4		BARBERIS 98B			450 $pp \to p_f f_2(1270)\pi p_s$
1730 ±20		[3] AMELIN 95B	VES		36 $\pi^- A \to \pi^+\pi^-\pi^- A$
1690 ±14		[4] BERDNIKOV 94	VES		37 $\pi^- A \to K^+ K^- \pi^- A$
1710 ±20	700	ANTIPOV 87	SIGM	−	50 π^- Cu $\to \mu^+\mu^-\pi^-$ Cu
1676 ± 6		[4] EVANGELISTA 81	OMEG	−	12 $\pi^- p \to 3\pi p$
1657 ±14		[4,5] DAUM 80D	SPEC	−	63–94 $\pi p \to 3\pi X$
1662 ±10	2000	[4] BALTAY 77	HBC	+	15 $\pi^+ p \to p 3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1742 ±31 ±49		ANTREASYAN 90	CBAL		$e^+e^- \to e^+e^-\pi^0\pi^0\pi^0$
1624 ±21		[1] BELLINI 85	SPEC		40 $\pi^- A \to \pi^-\pi^+\pi^- A$
1622 ±35		[6] BELLINI 85	SPEC		40 $\pi^- A \to \pi^-\pi^+\pi^- A$
1693 ±28		[7] BELLINI 85	SPEC		40 $\pi^- A \to \pi^-\pi^+\pi^- A$
1710 ±20		[8] DAUM 81B	SPEC	−	63,94 $\pi^- p$
1660 ±10		[4] ASCOLI 73	HBC	−	5–25 $\pi^- p \to p\pi_2$

[1] From $f_2(1270)\pi$ decay.
[2] From a fit to the invariant mass distribution.
[3] From a fit to $J^{PC} = 2^{-+}$ $f_2(1270)\pi$, $f_0(1370)\pi$ waves.
[4] From a fit to $J^P = 2^- S$-wave $f_2(1270)\pi$ partial wave.
[5] Clear phase rotation seen in $2^- S$, $2^- P$, $2^- D$ waves. We quote central value and spread of single-resonance fits to three channels.
[6] From $\rho\pi$ decay.
[7] From $\sigma\pi$ decay.
[8] From a two-resonance fit to four $2^- 0^+$ waves. This should not be averaged with all the single resonance fits.



$\pi_2(1670)$ mass (MeV)

π_2(1670) WIDTH

259± 9 OUR NEW AVERAGE Error includes scale factor of 1.3. See the ideogram below. [259 ± 10 MeV OUR 2002 AVERAGE Scale factor = 1.4]

VALUE (MeV)	*EVTS*	*DOCUMENT ID*	*TECN*	*CHG*	*COMMENT*
254± 3±31		[9] CHUNG 02	MPS		18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
265± 30±40		[10] BARBERIS 01			450 $p p \rightarrow p_f 3\pi^0 p_s$
168± 43±53		AMELIN 99	VES		37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
268± 15		BARBERIS 98B			450 $p p \rightarrow p_f \rho \pi p_s$
256± 15		BARBERIS 98B			450 $p p \rightarrow p_f f_2(1270) \pi p_s$
310± 20		[11] AMELIN 95B	VES		36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
190± 50		[12] BERDNIKOV 94	VES		37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
170± 80	700	ANTIPOV 87	SIGM	−	50 π^- Cu $\rightarrow \mu^+ \mu^- \pi^-$ Cu
260± 20		[12] EVANGELISTA 81	OMEG	−	12 $\pi^- p \rightarrow 3\pi p$
219± 20		[12,13] DAUM 80D	SPEC	−	63–94 $\pi p \rightarrow 3\pi X$
285± 60	2000	[12] BALTAY 77	HBC	+	15 $\pi^+ p \rightarrow p 3\pi$

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

236± 49±36	ANTREASYAN	90	CBAL		$e^+e^- \to e^+e^-\pi^0\pi^0\pi^0$
304± 22	[9] BELLINI	85	SPEC		$40\ \pi^- A \to \pi^-\pi^+\pi^- A$
404±108	[14] BELLINI	85	SPEC		$40\ \pi^- A \to \pi^-\pi^+\pi^- A$
330± 90	[15] BELLINI	85	SPEC		$40\ \pi^- A \to \pi^-\pi^+\pi^- A$
312± 50	[16] DAUM	81B	SPEC	−	$63{,}94\ \pi^- p$
270± 60	[12] ASCOLI	73	HBC	−	$5\text{–}25\ \pi^- p \to p\pi_2$

[9] From $f_2(1270)\pi$ decay.

[10] From a fit to the invariant mass distribution.

[11] From a fit to $J^{PC} = 2^{-+}$ $f_2(1270)\pi$, $f_0(1370)\pi$ waves.

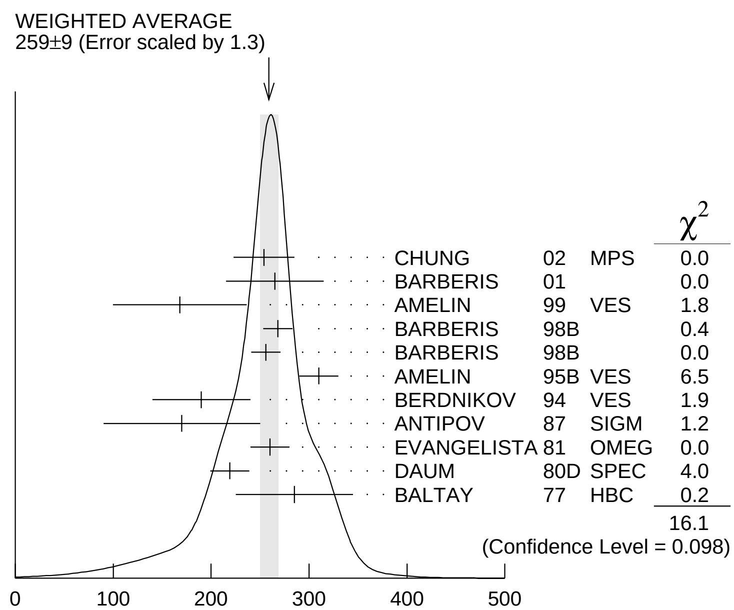
[12] From a fit to $J^P = 2^-$ $f_2(1270)\pi$ partial wave.

[13] Clear phase rotation seen in $2^- S$, $2^- P$, $2^- D$ waves. We quote central value and spread of single-resonance fits to three channels.

[14] From $\rho\pi$ decay.

[15] From $\sigma\pi$ decay.

[16] From a two-resonance fit to four 2^-0^+ waves. This should not be averaged with all the single resonance fits.



$\pi_2(1670)$ width (MeV)

$\pi_2(1670)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	3π	(95.8 ± 1.4) %	
Γ_2	$\pi^+\pi^-\pi^0$		
Γ_3	$\pi^0\pi^0\pi^0$		
Γ_4	$f_2(1270)\pi$	(56.2 ± 3.2) %	
Γ_5	$\rho\pi$	$(31\ \pm4\ )$ %	
Γ_6	$\sigma\pi$	$(13\ \pm4\ )$ %	
Γ_7	$f_0(1370)\pi$	$(\ 8.7\pm3.4)$ %	
Γ_8	$K\overline{K}^*(892)+$ c.c.	$(\ 4.2\pm1.4)$ %	
Γ_9	$\omega\rho$	$(\ 2.7\pm1.1)$ %	
Γ_{10}	$\gamma\gamma$		
Γ_{11}	$\eta\pi$		
Γ_{12}	$\pi^\pm 2\pi^+ 2\pi^-$		
Γ_{13}	$\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%
Γ_{14}	$b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 6 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 =$ 1.9 for 3 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	−53		
x_7	−29	−59	
x_8	−8	−21	−9
	x_4	x_5	x_7

$\pi_2(1670)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ Γ_{10}

VALUE (keV)	*CL%*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
<0.072	90	[17] ACCIARRI	97T	L3		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
<0.19	90	[17] ALBRECHT	97B	ARG		$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.41 ±0.23±0.28		ANTREASYAN	90	CBAL	0	$e^+e^- \to e^+e^-\pi^0\pi^0\pi^0$
0.8 ±0.3 ±0.12		[18] BEHREND	90C	CELL	0	$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$
1.3 ±0.3 ±0.2		[19] BEHREND	90C	CELL	0	$e^+e^- \to e^+e^-\pi^+\pi^-\pi^0$

[17] Decaying into $f_2(1270)\pi$ and $\rho\pi$.
[18] Constructive interference between $f_2(1270)\pi$,$\rho\pi$ and background.
[19] Incoherent Ansatz.

π_2(1670) BRANCHING RATIOS

$\Gamma(3\pi)/\Gamma_{total}$ — $\Gamma_1/\Gamma = (\Gamma_4+\Gamma_5+\Gamma_7)/\Gamma$

VALUE	DOCUMENT ID
0.958±0.014 OUR FIT	

$\Gamma(\pi^0\pi^0\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_3/Γ_2

VALUE	DOCUMENT ID		COMMENT
0.29±0.03±0.05	[20] BARBERIS	01	450 $p p \to p_f 3\pi^0 p_s$

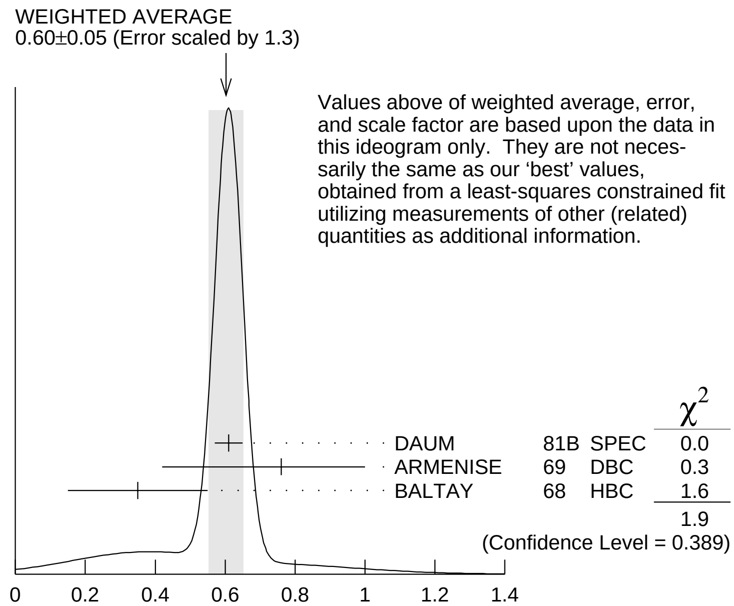
$\Gamma(\rho\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ — $\frac{1}{2}\Gamma_5/(0.567\Gamma_4+\frac{1}{2}\Gamma_5+0.624\Gamma_7)$

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.29±0.04 OUR FIT					
0.29±0.05	[21] DAUM	81B	SPEC		63,94 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.3	BARTSCH	68	HBC	+	8 $\pi^+ p \to 3\pi p$

$\Gamma(f_2(1270)\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ — $0.567\Gamma_4/(0.567\Gamma_4+\frac{1}{2}\Gamma_5+0.624\Gamma_7)$

(With $f_2(1270) \to \pi^+\pi^-$.)

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.604±0.035 OUR FIT					
0.60 ±0.05 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
0.61 ±0.04	[21] DAUM	81B	SPEC		63,94 $\pi^- p$
0.76 $^{+0.24}_{-0.34}$	ARMENISE	69	DBC	+	5.1 $\pi^+ d \to d 3\pi$
0.35 ±0.20	BALTAY	68	HBC	+	7–8.5 $\pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.59	BARTSCH	68	HBC	+	8 $\pi^+ p \to 3\pi p$



$\Gamma\big(f_2(1270)\pi\big)/\Gamma\big(\pi^{\pm}\pi^{+}\pi^{-}\big)$

$\Gamma(\rho\pi)/\Gamma(f_2(1270)\pi)$ — $\Gamma_5/0.564\Gamma_4$

(With $f_2(1270) \to \pi^+\pi^-$.)

VALUE	DOCUMENT ID		TECN	COMMENT
0.97±0.09 OUR NEW AVERAGE Error includes scale factor of 1.9. [1.01 ± 0.05 OUR 2002 AVERAGE]				
0.76±0.07±0.10	CHUNG	02	MPS	18.3 $\pi^- p \to \pi^+\pi^-\pi^- p$
1.01±0.05	BARBERIS	98B		450 $pp \to p_f \pi^+\pi^-\pi^0 p_s$

$\Gamma(\eta\pi)/\Gamma(\pi^{\pm}\pi^{+}\pi^{-})$ — $\Gamma_{11}/(0.567\Gamma_4+\frac{1}{2}\Gamma_5+0.624\Gamma_7)$

(All η decays.)

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
<0.09	BALTAY	68	HBC	+	7–8.5 $\pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.10	CRENNELL	70	HBC	−	6 $\pi^- p \to f_2\pi^- N$

$\Gamma(\pi^{\pm}2\pi^{+}2\pi^{-})/\Gamma(\pi^{\pm}\pi^{+}\pi^{-})$ — $\Gamma_{12}/(0.567\Gamma_4+\frac{1}{2}\Gamma_5+0.624\Gamma_7)$

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
<0.10	CRENNELL	70	HBC	−	6 $\pi^- p \to f_2\pi^- N$
<0.1	BALTAY	68	HBC	+	7,8.5 $\pi^+ p$

$\Gamma(\rho(1450)\pi)/\Gamma_{total}$ — Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0036	97.7	AMELIN	99	VES	37 $\pi^- A \to \omega\pi^-\pi^0 A^*$

$\Gamma(b_1(1235)\pi)/\Gamma_{total}$ — Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0019	97.7	AMELIN	99	VES	37 $\pi^- A \to \omega\pi^-\pi^0 A^*$

$\Gamma(f_0(1370)\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ — $0.624\Gamma_7/(0.567\Gamma_4+\frac{1}{2}\Gamma_5+0.624\Gamma_7)$

(With $f_0(1370) \to \pi^+\pi^-$.)

VALUE	DOCUMENT ID		TECN	COMMENT
0.10±0.04 OUR FIT				
0.10±0.05	[21] DAUM	81B	SPEC	63,94 $\pi^- p$

$\Gamma(K\overline{K}^*(892)+\text{c.c.})/\Gamma(f_2(1270)\pi)$ — Γ_8/Γ_4

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.075±0.025 OUR FIT					
0.075±0.025	[22] ARMSTRONG	82B	OMEG	−	16 $\pi^- p \to K^+ K^- \pi^- p$

$\Gamma(\omega\rho)/\Gamma_{total}$ — Γ_9/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.027±0.004±0.010	[23] AMELIN	99	VES	37 $\pi^- A \to \omega\pi^-\pi^0 A^*$

$\Gamma(\sigma\pi)/\Gamma(f_2(1270)\pi)$ — Γ_6/Γ_4

VALUE	DOCUMENT ID		TECN	COMMENT
0.24±0.07 OUR NEW AVERAGE	[0.24 ± 0.10 OUR 2002 AVERAGE]			
0.24±0.03±0.10	CHUNG	02	MPS	18.3 $\pi^- p \to \pi^+\pi^-\pi^- p$
0.24±0.10	[24,25] BAKER	99	SPEC	1.94 $\overline{p}p \to 4\pi^0$

D-wave/S-wave RATIO FOR $\pi_2(1670) \to f_2(1270)\pi$

VALUE	DOCUMENT ID		TECN	COMMENT
−0.18±0.06	[24] BAKER	99	SPEC	1.94 $\overline{p}p \to 4\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.22±0.10	[21] DAUM	81B	SPEC	63,94 $\pi^- p$

F-wave/P-wave RATIO FOR $\pi_2(1670) \to \rho\pi$

VALUE	DOCUMENT ID		TECN	COMMENT
−0.72±0.07±0.14	CHUNG	02	MPS	18.3 $\pi^- p \to \pi^+\pi^-\pi^- p$

[20] Using BARBERIS 98B.
[21] From a two-resonance fit to four 2^-0^+ waves.
[22] From a partial-wave analysis of $K^+K^-\pi^-$ system.
[23] Normalized to the B($\pi_2(1670) \to f_2\pi$).
[24] Using preliminary CBAR data.
[25] With the $\sigma\pi$ in L=2 and the $f_2(1270)\pi$ in L=0.

$\pi_2(1670)$ REFERENCES

CHUNG	02	PR D65 072001	S.U. Chung *et al.*		
BARBERIS	01	PL B507 14	D. Barberis *et al.*		
AMELIN	99	PAN 62 445	D.V. Amelin *et al.*	(VES Collab.)	
		Translated from YAF 62 487.			
BAKER	99	PL B449 114	C.A. Baker *et al.*		
BARBERIS	98B	PL B422 399	D. Barberis *et al.*	(WA 102 Collab.)	
ACCIARRI	97T	PL B413 147	M. Acciarri *et al.*	(L3 Collab.)	
ALBRECHT	97B	ZPHY C74 469	H. Albrecht *et al.*	(ARGUS Collab.)	
AMELIN	95B	PL B356 595	D.V. Amelin *et al.*	(SERP, TBIL)	
BERDNIKOV	94	PL B337 219	E.B. Berdnikov *et al.*	(SERP, TBIL)	
ANTREASYAN	90	ZPHY C48 561	D. Antreasyan *et al.*	(Crystal Ball Collab.)	
BEHREND	90C	ZPHY C46 583	H.J. Behrend *et al.*	(CELLO Collab.)	
ANTIPOV	87	EPL 4 403	Y.M. Antipov *et al.*	(SERP, JINR, INRM+)	
BELLINI	85	SJNP 41 781	D. Bellini *et al.*		
		Translated from YAF 41 1223.			
ARMSTRONG	82B	NP B202 1	T.A. Armstrong, B. Baccari	(AACH3, BARI, BONN+)	
DAUM	81B	NP B182 269	C. Daum *et al.*	(AMST, CERN, CRAC, MPIM+)	
EVANGELISTA	81	NP B178 197	C. Evangelista *et al.*	(BARI, BONN, CERN+)	
Also	81B	NP B186 594	C. Evangelista		
DAUM	80D	PL 89B 285	C. Daum *et al.*	(AMST, CERN, CRAC, MPIM+)	JP
BALTAY	77	PRL 39 591	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU)	JP
ASCOLI	73	PR D7 669	G. Ascoli	(ILL, TNTO, GENO, HAMB, MILA+)	JP
CRENNELL	70	PRL 24 781	D.J. Crennell *et al.*	(BNL)	
ARMENISE	69	LNC 2 501	N. Armenise *et al.*	(BARI, BGNA, FIRZ)	
BALTAY	68	PRL 20 887	C. Baltay *et al.*	(COLU, ROCH, RUTG, YALE)	I
BARTSCH	68	NP B7 345	J. Bartsch *et al.*	(AACH, BERL, CERN)	JP

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		Translated from SJPN 30 5.		
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CHEN	83B	PR D28 2304	T.Y. Chen *et al.*	(ARIZ, FNAL, FLOR, NDAM+)
LEEDOM	83	PR D27 1426	I.D. Leedom *et al.*	(PURD, TNTO)
BELLINI	82B	NP B199 1	G. Bellini *et al.*	(CERN, MILA, JINR+)
DAUM	81B	NP B182 269	C. Daum *et al.*	(AMST, CERN, CRAC, MPIM+)
PERNEGR	78	NP B134 436	J. Pernegr *et al.*	(ETH, CERN, LOIC+)
FOCACCI	66	PRL 17 890	M.N. Focacci *et al.*	(CERN)
LEVRAT	66	PL 22 714	B. Levrat *et al.*	
VETLITSKY	66	PL 21 579	I.A. Vetlitsky *et al.*	(ITEP)
FORINO	65B	PL 19 68	A. Forino *et al.*	(BGNA, BARI, FIRZ, ORSAY+)