

$\Lambda(1820) \ 5/2^+$  $I(J^P) = 0(\frac{5}{2}^+)$  Status: \*\*\*\*

This resonance is the cornerstone for all partial-wave analyses in this region. Most of the results published before 1973 are now obsolete and have been omitted. They may be found in our 1982 edition *Physics Letters* **111B** 1 (1982).

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### $\Lambda(1820)$ POLE POSITION

**REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1812 to 1825 (<math>\approx</math> 1818) OUR ESTIMATE</b>			
1813 $\pm$ 3	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
1824 $^{+2}_{-1}$	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
••• We do not use the following data for averages, fits, limits, etc. •••			
1814	ZHANG	13A	DPWA $\bar{K}N$ multichannel
<sup>1</sup> From the preferred solution A in KAMANO 15.			

**−2×IMAGINARY PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>75 to 80 (<math>\approx</math> 77) OUR ESTIMATE</b>			
78 $\pm$ 7	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
77 $\pm$ 2	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
••• We do not use the following data for averages, fits, limits, etc. •••			
85	ZHANG	13A	DPWA $\bar{K}N$ multichannel
<sup>1</sup> From the preferred solution A in KAMANO 15.			

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### $\Lambda(1820)$ POLE RESIDUES

The normalized residue is the residue divided by  $\Gamma_{pole}/2$ .

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow N\bar{K}$** 

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.60 <math>\pm</math>0.12</b>	<b>−22 <math>\pm</math> 5</b>	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
••• We do not use the following data for averages, fits, limits, etc. •••				
0.558	−13	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
<sup>1</sup> From the preferred solution A in KAMANO 15.				

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma\pi$** 

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.34 <math>\pm</math>0.07</b>	<b>174 <math>\pm</math> 5</b>	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
••• We do not use the following data for averages, fits, limits, etc. •••				
0.357	168	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
<sup>1</sup> From the preferred solution A in KAMANO 15.				

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Lambda\eta$** 

<u>MODULUS</u>	<u>PHASE (<math>^{\circ}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0184	-3	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Xi K$** 

<u>MODULUS</u>	<u>PHASE (<math>^{\circ}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.00111	70	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi$ ,  $P$ -wave**

<u>MODULUS</u>	<u>PHASE (<math>^{\circ}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>0.07 ± 0.02</b>	<b>-60 ± 50</b>	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.340	161	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi$ ,  $F$ -wave**

<u>MODULUS</u>	<u>PHASE (<math>^{\circ}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>0.11 ± 0.04</b>	<b>5 ± 45</b>	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.201	151	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow N\bar{K}^*(892)$ ,  $S=1/2$ ,  $F$ -wave**

<u>MODULUS</u>	<u>PHASE (<math>^{\circ}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>0.02 ± 0.02</b>		SARANTSEV	19	DPWA $\bar{K}N$ multichannel
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.00750	41	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow N\bar{K}^*(892)$ ,  $S=3/2$ ,  $P$ -wave**

<u>MODULUS</u>	<u>PHASE (<math>^{\circ}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>0.35 ± 0.15</b>	<b>-30 ± 45</b>	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.171	-139	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15.

**Normalized residue in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow N\bar{K}^*(892)$ ,  $S=3/2$ ,  $F$ -wave**

<u>MODULUS</u>	<u>PHASE (<math>^{\circ}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>0.02 ± 0.02</b>		SARANTSEV	19	DPWA $\bar{K}N$ multichannel
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.000517	161	<sup>1</sup> KAMANO	15	DPWA $\bar{K}N$ multichannel
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<sup>1</sup>From the preferred solution A in KAMANO 15. **$\Lambda(1820)$  MASS**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>1815 to 1825 (<math>\approx 1820</math>) OUR ESTIMATE</b>			
1822 $\pm 4$	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
1823.5 $\pm 0.8$	ZHANG	13A	DPWA $\bar{K}N$ multichannel
1823 $\pm 3$	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
1819 $\pm 2$	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
1821 $\pm 2$	KANE	74	DPWA $K^- p \rightarrow \Sigma \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1830	DECLAIS	77	DPWA $\bar{K}N \rightarrow \bar{K}N$
1822 $\pm 2$	GOPAL	77	DPWA $\bar{K}N$ multichannel
1817 or 1819	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel

<sup>1</sup>The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit. **$\Lambda(1820)$  WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>70 to 90 (<math>\approx 80</math>) OUR ESTIMATE</b>			
80 $\pm 8$	SARANTSEV	19	DPWA $\bar{K}N$ multichannel
89 $\pm 2$	ZHANG	13A	DPWA $\bar{K}N$ multichannel
77 $\pm 5$	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
72 $\pm 5$	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
87 $\pm 3$	KANE	74	DPWA $K^- p \rightarrow \Sigma \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
82	DECLAIS	77	DPWA $\bar{K}N \rightarrow \bar{K}N$
81 $\pm 5$	GOPAL	77	DPWA $\bar{K}N$ multichannel
76 or 76	<sup>1</sup> MARTIN	77	DPWA $\bar{K}N$ multichannel

<sup>1</sup>The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit. **$\Lambda(1820)$  DECAY MODES**

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $N\bar{K}$	55–65 %
$\Gamma_2$ $\Sigma \pi$	8–14 %
$\Gamma_3$ $\Sigma(1385)\pi$	5–10 %
$\Gamma_4$ $\Sigma(1385)\pi$ , <i>P</i> -wave	
$\Gamma_5$ $\Sigma(1385)\pi$ , <i>F</i> -wave	(2.0 $\pm$ 1.0) %
$\Gamma_6$ $\Lambda\eta$	
$\Gamma_7$ $\Xi K$	
$\Gamma_8$ $\Sigma \pi \pi$	
$\Gamma_9$ $N\bar{K}^*(892)$ , <i>S</i> =1/2, <i>F</i> -wave	
$\Gamma_{10}$ $N\bar{K}^*(892)$ , <i>S</i> =3/2, <i>P</i> -wave	(3.0 $\pm$ 1.0) %
$\Gamma_{11}$ $N\bar{K}^*(892)$ , <i>S</i> =3/2, <i>F</i> -wave	

**$\Lambda(1820)$  BRANCHING RATIOS**

Errors quoted do not include uncertainties in the parametrizations used in the partial-wave analyses and are thus too small. See also “Sign conventions for resonance couplings” in the Note on  $\Lambda$  and  $\Sigma$  Resonances.

 **$\Gamma(N\bar{K})/\Gamma_{\text{total}}$   $\Gamma_1/\Gamma$** 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.55 to 0.65 OUR ESTIMATE</b>			
0.58 $\pm$ 0.12	SARANTSEV 19	DPWA	$\bar{K}N$ multichannel
0.54 $\pm$ 0.01	ZHANG 13A	DPWA	$\bar{K}N$ multichannel
0.58 $\pm$ 0.02	GOPAL 80	DPWA	$\bar{K}N \rightarrow \bar{K}N$
0.60 $\pm$ 0.03	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.547	<sup>1</sup> KAMANO 15	DPWA	$\bar{K}N$ multichannel
0.51	DECLAIS 77	DPWA	$\bar{K}N \rightarrow \bar{K}N$
0.57 $\pm$ 0.02	GOPAL 77	DPWA	See GOPAL 80
0.59 or 0.58	<sup>2</sup> MARTIN 77	DPWA	$\bar{K}N$ multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15.

<sup>2</sup> The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.

 **$\Gamma(\Sigma\pi)/\Gamma_{\text{total}}$   $\Gamma_2/\Gamma$** 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.19 <math>\pm</math>0.04</b>			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.218	<sup>1</sup> KAMANO 15	DPWA	$\bar{K}N$ multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15.

 **$\Gamma(\Sigma(1385)\pi, P\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_4/\Gamma$** 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$\sim$ 0.01			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.173	<sup>1</sup> KAMANO 15	DPWA	$\bar{K}N$ multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15.

 **$\Gamma(\Sigma(1385)\pi, F\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_5/\Gamma$** 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.02 <math>\pm</math>0.01</b>			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.055	<sup>1</sup> KAMANO 15	DPWA	$\bar{K}N$ multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15.

 **$\Gamma(\Lambda\eta)/\Gamma_{\text{total}}$   $\Gamma_6/\Gamma$** 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.001	<sup>1</sup> KAMANO 15	DPWA	Multichannel

<sup>1</sup> From the preferred solution A in KAMANO 15.

$\Gamma(\Xi K)/\Gamma_{\text{total}}$   $\Gamma_7/\Gamma$ 

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

not seen	<sup>1</sup> KAMANO	15	DPWA Multichannel
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<sup>1</sup> From the preferred solution A in KAMANO 15.

 $\Gamma(\Sigma \pi \pi)/\Gamma_{\text{total}}$   $\Gamma_8/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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no clear signal	<sup>1</sup> ARMENTEROS68C	HDBC	$K^- N \rightarrow \Sigma \pi \pi$
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<sup>1</sup> There is a suggestion of a bump, enough to be consistent with what is expected from  $\Sigma(1385) \rightarrow \Sigma \pi$  decay.

 $\Gamma(N\bar{K}^*(892), S=1/2, F\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_9/\Gamma$ 

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

not seen	<sup>1</sup> KAMANO	15	DPWA Multichannel
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<sup>1</sup> From the preferred solution A in KAMANO 15.

 $\Gamma(N\bar{K}^*(892), S=3/2, P\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_{10}/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<b>0.03 ± 0.01</b>	ZHANG	13A	DPWA Multichannel
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.006	<sup>1</sup> KAMANO	15	DPWA Multichannel
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<sup>1</sup> From the preferred solution A in KAMANO 15.

 $\Gamma(N\bar{K}^*(892), S=3/2, F\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_{11}/\Gamma$ 

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

not seen	<sup>1</sup> KAMANO	15	DPWA Multichannel
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<sup>1</sup> From the preferred solution A in KAMANO 15.

 $(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma \pi$   $(\Gamma_1 \Gamma_2)^{1/2}/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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-0.28 ± 0.01	ZHANG	13A	DPWA Multichannel
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-0.28 ± 0.03	GOPAL	77	DPWA $\bar{K} N$ multichannel
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-0.28 ± 0.01	KANE	74	DPWA $K^- p \rightarrow \Sigma \pi$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

-0.25 or -0.25	<sup>1</sup> MARTIN	77	DPWA $\bar{K} N$ multichannel
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<sup>1</sup> The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.

 $(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi, P\text{-wave}$   $(\Gamma_1 \Gamma_4)^{1/2}/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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-0.20 ± 0.02	ZHANG	13A	DPWA Multichannel
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-0.167 ± 0.054	<sup>1</sup> CAMERON	78	DPWA $K^- p \rightarrow \Sigma(1385)\pi$
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+0.27 ± 0.03	PREVOST	74	DPWA $K^- N \rightarrow \Sigma(1385)\pi$
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<sup>1</sup> The published sign has been changed to be in accord with the baryon-first convention.

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Sigma(1385)\pi$ , F-wave	$(\Gamma_1 \Gamma_5)^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN COMMENT
$+0.065 \pm 0.029$	<sup>1</sup> CAMERON 78 DPWA $K^- p \rightarrow \Sigma(1385)\pi$

<sup>1</sup> The published sign has been changed to be in accord with the baryon-first convention.

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(1820) \rightarrow \Lambda\eta$	$(\Gamma_1 \Gamma_6)^{1/2} / \Gamma$
VALUE	DOCUMENT ID TECN
$-0.096^{+0.040}_{-0.020}$	RADER 73 MPWA

## $\Lambda(1820)$ REFERENCES

SARANTSEV 19	EPJ A55 180	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
KAMANO 15	PR C92 025205	H. Kamano <i>et al.</i>	(ANL, OSAK)
ZHANG 13A	PR C88 035205	H. Zhang <i>et al.</i>	(KSU)
PDG 82	PL 111B 1	M. Roos <i>et al.</i>	(HELS, CIT, CERN)
GOPAL 80	Toronto Conf. 159	G.P. Gopal	(RHEL) IJP
ALSTON-... 78	PR D18 182	M. Alston-Garnjost <i>et al.</i>	(LBL, MTHO+) IJP
Also	PRL 38 1007	M. Alston-Garnjost <i>et al.</i>	(LBL, MTHO+) IJP
CAMERON 78	NP B143 189	W. Cameron <i>et al.</i>	(RHEL, LOIC) IJP
DECLAIS 77	CERN 77-16	Y. Declais <i>et al.</i>	(CAEN, CERN) IJP
GOPAL 77	NP B119 362	G.P. Gopal <i>et al.</i>	(LOIC, RHEL) IJP
MARTIN 77	NP B127 349	B.R. Martin, M.K. Pidcock, R.G. Moorhouse	(LOUC+) IJP
Also	NP B126 266	B.R. Martin, M.K. Pidcock	(LOUC)
Also	NP B126 285	B.R. Martin, M.K. Pidcock	(LOUC) IJP
KANE 74	LBL-2452	D.F. Kane	(LBL) IJP
PREVOST 74	NP B69 246	J. Prevost <i>et al.</i>	(SACL, CERN, HEID)
RADER 73	NC 16A 178	R.K. Rader <i>et al.</i>	(SACL, HEID, CERN+)
ARMENTEROS 68C	NP B8 216	R. Armenteros <i>et al.</i>	(CERN, HEID, SACL) I