$\Sigma(2030)\ 7/2^+$

$I(J^P) = 1(\frac{7}{2}^+)$ Status: ∗∗∗∗

Discovered by COOL 66 and by WOHL 66. For most results published before 1974 (they are now obsolete), see our 1982 edition Physics Letters **111B** 1 (1982).

This entry only includes results from partial-wave analyses. Parameters of peaks seen in cross sections and invariant-mass distributions around 2030 MeV may be found in our 1984 edition, Reviews of Modern Physics **56** S1 (1984).

$\Sigma(2030)$ POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
$\mathbf{2025^{+10}_{-5}}$	[1] KAMANO	15	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1993	ZHANG	13A	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$-2\times$IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
$\mathbf{130^{+6}_{-24}}$	[1] KAMANO	15	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
176	ZHANG	13A	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Sigma(2030)$ POLE RESIDUES

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

Normalized residue in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow N\overline{K}$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.220	−38	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow \Sigma\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0807	135	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow \Lambda\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.138	−24	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow \Xi K$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0348	129	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow \Sigma(1385)\pi$, F-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.089	−23	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow \Sigma(1385)\pi$, H-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0245	132	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow N\overline{K}^*(892)$, S=1/2 , F-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.193	38	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow N\overline{K}^*(892)$, S=3/2 , F-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.320	37	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

Normalized residue in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow N\overline{K}^*(892)$, S=3/2 , H-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.00358	22	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

Σ(2030) MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
2025 to 2040 (≈ 2030) OUR ESTIMATE				
2030±5	ZHANG	13A	DPWA	Multichannel
2036±5	GOPAL	80	DPWA	$\overline{K}N \rightarrow \overline{K}N$
2038±10	CORDEN	77B		$K^- N \rightarrow N\overline{K}^*$
2040±5	GOPAL	77	DPWA	$\overline{K}N$ multichannel
2030±3	[1] CORDEN	76	DPWA	$K^- n \rightarrow \Lambda\pi^-$
2035±15	BAILLON	75	IPWA	$\overline{K}N \rightarrow \Lambda\pi$
2038±10	HEMINGWAY	75	DPWA	$K^- p \rightarrow \overline{K}N$
2042±11	VANHORN	75	DPWA	$K^- p \rightarrow \Lambda\pi^0$
2020±6	KANE	74	DPWA	$K^- p \rightarrow \Sigma\pi$
2035±10	LITCHFIELD	74B	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$
2020±30	LITCHFIELD	74C	DPWA	$K^- p \rightarrow \Delta(1232)\overline{K}$
2025±10	LITCHFIELD	74D	DPWA	$K^- p \rightarrow \Lambda(1820)\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2027 to 2057	GOYAL	77	DPWA	$K^- N \rightarrow \Sigma\pi$
2030	DEBELLEFON	76	IPWA	$K^- p \rightarrow \Lambda\pi^0$

[1] Preferred solution 3; see CORDEN 76 for other possibilities.

Σ(2030) WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
150 to 200 (≈ 180) OUR ESTIMATE				
207±17	ZHANG	13A	DPWA	Multichannel
172±10	GOPAL	80	DPWA	$\overline{K}N \rightarrow \overline{K}N$
137±40	CORDEN	77B		$K^- N \rightarrow N\overline{K}^*$
190±10	GOPAL	77	DPWA	$\overline{K}N$ multichannel
201±9	[1] CORDEN	76	DPWA	$K^- n \rightarrow \Lambda\pi^-$
180±20	BAILLON	75	IPWA	$\overline{K}N \rightarrow \Lambda\pi$
172±15	HEMINGWAY	75	DPWA	$K^- p \rightarrow \overline{K}N$
178±13	VANHORN	75	DPWA	$K^- p \rightarrow \Lambda\pi^0$
111±5	KANE	74	DPWA	$K^- p \rightarrow \Sigma\pi$
160±20	LITCHFIELD	74B	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$
200±30	LITCHFIELD	74C	DPWA	$K^- p \rightarrow \Delta(1232)\overline{K}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
260	DECLAIS	77	DPWA	$\overline{K}N \rightarrow \overline{K}N$
126 to 195	GOYAL	77	DPWA	$K^- N \rightarrow \Sigma\pi$
160	DEBELLEFON	76	IPWA	$K^- p \rightarrow \Lambda\pi^0$
70 to 125	LITCHFIELD	74D	DPWA	$K^- p \rightarrow \Lambda(1820)\pi^0$

[1] Preferred solution 3; see CORDEN 76 for other possibilities.

$\Sigma(2030)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\overline{K}$	17–23 %
Γ_2	$\Lambda\pi$	17–23 %
Γ_3	$\Sigma\pi$	5–10 %
Γ_4	ΞK	<2 %
Γ_5	$\Sigma(1385)\pi$	5–15 %
Γ_6	$\Sigma(1385)\pi$, F-wave	
Γ_7	$\Sigma(1385)\pi$, F-wave	
Γ_8	$\Sigma(1385)\pi$, H-wave	
Γ_9	$\Lambda(1520)\pi$	10–20 %
Γ_{10}	$\Lambda(1520)\pi$, D-wave	
Γ_{11}	$\Lambda(1520)\pi$, G-wave	
Γ_{12}	$\Delta(1232)\overline{K}$	10–20 %
Γ_{13}	$\Delta(1232)\overline{K}$, F-wave	
Γ_{14}	$\Delta(1232)\overline{K}$, H-wave	
Γ_{15}	$N\overline{K}^*(892)$	<5 %
Γ_{16}	$N\overline{K}^*(892)$, S=1/2, F-wave	
Γ_{17}	$N\overline{K}^*(892)$, S=3/2, F-wave	
Γ_{18}	$N\overline{K}^*(892)$, S=3/2, H-wave	
Γ_{19}	$\Lambda(1820)\pi$, P-wave	

$\Sigma(2030)$ BRANCHING RATIOS

See "Sign conventions for resonance couplings" in the Note on Λ and Σ Resonances.

$\Gamma(N\overline{K})/\Gamma_{total}$ — Γ_1/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.17 to 0.23 OUR ESTIMATE				
0.13 ±0.01	ZHANG	13A	DPWA	Multichannel
0.19 ±0.03	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$
0.18 ±0.03	HEMINGWAY	75	DPWA	$K^- p \to \overline{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.269	[1] KAMANO	15	DPWA	Multichannel
0.15	DECLAIS	77	DPWA	$\overline{K}N \to \overline{K}N$
0.24 ±0.02	GOPAL	77	DPWA	See GOPAL 80

[1] From the preferred solution A in KAMANO 15.

$\Gamma(\Lambda\pi)/\Gamma_{total}$ — Γ_2/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.080	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(\Sigma\pi)/\Gamma_{total}$ — Γ_3/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.037	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(\Xi K)/\Gamma_{total}$ — Γ_4/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.006	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(\Sigma(1385)\pi, F\text{-wave})/\Gamma_{total}$ — Γ_7/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.030	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(\Sigma(1385)\pi, H\text{-wave})/\Gamma_{total}$ — Γ_8/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.003	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(N\overline{K}^*(892), S=1/2, F\text{-wave})/\Gamma_{total}$ — Γ_{16}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.154	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(N\overline{K}^*(892), S=3/2, F\text{-wave})/\Gamma_{total}$ — Γ_{17}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.422	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$\Gamma(N\overline{K}^*(892), S=3/2, H\text{-wave})/\Gamma_{total}$ — Γ_{18}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	[1] KAMANO	15	DPWA	Multichannel

[1] From the preferred solution A in KAMANO 15.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Lambda\pi$ — $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
+0.15 ±0.01	ZHANG	13A	DPWA	Multichannel
+0.18 ±0.02	GOPAL	77	DPWA	$\overline{K}N$ multichannel
+0.20 ±0.01	[1] CORDEN	76	DPWA	$K^- n \to \Lambda\pi^-$
+0.18 ±0.02	BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$
+0.20 ±0.01	VANHORN	75	DPWA	$K^- p \to \Lambda\pi^0$
+0.195±0.053	DEVENISH	74B		Fixed-t dispersion rel.
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.20	DEBELLEFON	76	IPWA	$K^- p \to \Lambda\pi^0$

[1] Preferred solution 3; see CORDEN 76 for other possibilities.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Sigma\pi$ — $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
−0.08 ±0.01	ZHANG	13A	DPWA	Multichannel
−0.09 ±0.01	[1] CORDEN	77C		$K^- n \to \Sigma\pi$
−0.06 ±0.01	[1] CORDEN	77C		$K^- n \to \Sigma\pi$
−0.15 ±0.03	GOPAL	77	DPWA	$\overline{K}N$ multichannel
−0.10 ±0.01	KANE	74	DPWA	$K^- p \to \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.085±0.02	[2] GOYAL	77	DPWA	$K^- N \to \Sigma\pi$

[1] The two entries for CORDEN 77C are from two different acceptable solutions.
[2] This coupling is extracted from unnormalized data.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Xi K$ — $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.023	MULLER	69B	DPWA	$K^- p \to \Xi K$
<0.05	BURGUN	68	DPWA	$K^- p \to \Xi K$
<0.05	TRIPP	67	RVUE	$K^- p \to \Xi K$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Sigma(1385)\pi$, F-wave — $(\Gamma_1\Gamma_6)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
+0.16 ±0.01	ZHANG	13A	DPWA	Multichannel
+0.153±0.026	[1] CAMERON	78	DPWA	$K^- p \to \Sigma(1385)\pi$

[1] The published sign has been changed to be in accord with the baryon-first convention.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2030) \to \Lambda(1520)\pi$, D-wave — $(\Gamma_1\Gamma_{10})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
+0.114±0.010	[1] CAMERON	77	DPWA	$K^- p \to \Lambda(1520)\pi^0$
0.14 ±0.03	LITCHFIELD	74B	DPWA	$K^- p \to \Lambda(1520)\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.10 ±0.03	[2] CORDEN	75B	DBC	$K^- n \to N\overline{K}\pi^-$

[1] The published sign has been changed to be in accord with the baryon-first convention.
[2] An upper limit.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow \Lambda(1520)\pi$, G-wave $(\Gamma_1\Gamma_{11})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.146\pm0.010$	[1] CAMERON	77	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$
0.02 ± 0.02	LITCHFIELD	74B	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$

[1] The published sign has been changed to be in accord with the baryon-first convention.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow \Delta(1232)\overline{K}$, F-wave $(\Gamma_1\Gamma_{13})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.12\pm0.02$	ZHANG	13A	DPWA	Multichannel
0.16 ± 0.03	LITCHFIELD	74C	DPWA	$K^- p \rightarrow \Delta(1232)\overline{K}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.17 ± 0.03	[1] CORDEN	75B	DBC	$K^- n \rightarrow N\overline{K}\pi^-$

[1] An upper limit.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow \Delta(1232)\overline{K}$, H-wave $(\Gamma_1\Gamma_{14})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.00 ± 0.02	LITCHFIELD	74C	DPWA	$K^- p \rightarrow \Delta(1232)\overline{K}$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow N\overline{K}^*(892)$, S=1/2, F-wave $(\Gamma_1\Gamma_{16})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.06\pm0.02$	ZHANG	13A	DPWA	Multichannel
$+0.06\pm0.03$	[1] CAMERON	78B	DPWA	$K^- p \rightarrow N\overline{K}^*$
-0.02 ± 0.01	CORDEN	77B		$K^- d \rightarrow NN\overline{K}^*$

[1] The published sign has been changed to be in accord with the baryon-first convention.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow N\overline{K}^*(892)$, S=3/2, F-wave $(\Gamma_1\Gamma_{17})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.05\pm0.01$	ZHANG	13A	DPWA	Multichannel
$+0.04\pm0.03$	[1] CAMERON	78B	DPWA	$K^- p \rightarrow N\overline{K}^*$
-0.12 ± 0.02	CORDEN	77B		$K^- d \rightarrow NN\overline{K}^*$

[1] The upper limit on the G_3 wave is 0.03.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(2030) \rightarrow \Lambda(1820)\pi$, P-wave $(\Gamma_1\Gamma_{19})^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.14 ± 0.02	CORDEN	75B	DBC	$K^- n \rightarrow N\overline{K}\pi^-$
0.18 ± 0.04	LITCHFIELD	74D	DPWA	$K^- p \rightarrow \Lambda(1820)\pi^0$

Σ(2030) REFERENCES

KAMANO	15	PR C92 025205	H. Kamano *et al.*	(ANL, OSAK)	
ZHANG	13A	PR C88 035205	H. Zhang *et al.*	(KSU)	
PDG	84	RMP 56 S1	C.G. Wohl *et al.*	(LBL, CIT, CERN)	
PDG	82	PL 111B 1	M. Roos *et al.*	(HELS, CIT, CERN)	
GOPAL	80	Toronto Conf. 159	G.P. Gopal	(RHEL)	IJP
CAMERON	78	NP B143 189	W. Cameron *et al.*	(RHEL, LOIC)	IJP
CAMERON	78B	NP B146 327	W. Cameron *et al.*	(RHEL, LOIC)	IJP
CAMERON	77	NP B131 399	W. Cameron *et al.*	(RHEL, LOIC)	IJP
CORDEN	77B	NP B121 365	M.J. Corden *et al.*	(BIRM)	IJP
CORDEN	77C	NP B125 61	M.J. Corden *et al.*	(BIRM)	IJP
DECLAIS	77	CERN 77-16	Y. Declais *et al.*	(CAEN, CERN)	IJP
GOPAL	77	NP B119 362	G.P. Gopal *et al.*	(LOIC, RHEL)	IJP
GOYAL	77	PR D16 2746	D.P. Goyal, A.V. Sodhi	(DELH)	IJP
CORDEN	76	NP B104 382	M.J. Corden *et al.*	(BIRM)	IJP
DEBELLEFON	76	NP B109 129	A. de Bellefon, A. Berthon	(CDEF)	IJP
BAILLON	75	NP B94 39	P.H. Baillon, P.J. Litchfield	(CERN, RHEL)	IJP
CORDEN	75B	NP B92 365	M.J. Corden *et al.*	(BIRM)	IJP
HEMINGWAY	75	NP B91 12	R.J. Hemingway *et al.*	(CERN, HEIDH, MPIM)	IJP
VANHORN	75	NP B87 145	A.J. van Horn	(LBL)	IJP
Also		NP B87 157	A.J. van Horn	(LBL)	IJP
DEVENISH	74B	NP B81 330	R.C.E. Devenish, C.D. Froggatt, B.R. Martin	(DESY+)	
KANE	74	LBL-2452	D.F. Kane	(LBL)	IJP
LITCHFIELD	74B	NP B74 19	P.J. Litchfield *et al.*	(CERN, HEIDH)	IJP
LITCHFIELD	74C	NP B74 39	P.J. Litchfield *et al.*	(CERN, HEIDH)	IJP
LITCHFIELD	74D	NP B74 12	P.J. Litchfield *et al.*	(CERN, HEIDH)	IJP
MULLER	69B	Thesis UCRL 19372	R.A. Muller	(LRL)	
BURGUN	68	NP B8 447	G. Burgun *et al.*	(SACL, CDEF, RHEL)	
TRIPP	67	NP B3 10	R.D. Tripp *et al.*	(LRL, SLAC, CERN+)	
COOL	66	PRL 16 1228	R.L. Cool *et al.*	(BNL)	
WOHL	66	PRL 17 107	C.G. Wohl, F.T. Solmitz, M.L. Stevenson	(LRL)	IJP