$\Sigma(1660)$ $1/2^+$

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

For results published before 1974 (they are now obsolete), see our 1982 edition Physics Letters **111B** 1 (1982).

Σ(1660) POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1585± 20	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1547^{+111}_{-59}	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15. Solution B reports M = 1457^{+5}_{-1} MeV.

−2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
$\mathbf{290^{+140}_{-40}}$	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
183^{+86}_{-78}	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15. Solution B reports Γ = 78^{+2}_{-8} MeV.

Σ(1660) POLE RESIDUES

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

Normalized residue in $N\overline{K} \to \Sigma(1660) \to N\overline{K}$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.07 ±0.03	**−165 ± 35**	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0247	168	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

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

Normalized residue in $N\overline{K} \to \Sigma(1660) \to \Sigma\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.17±0.04	**150 ± 20**	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.16	78	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

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

Normalized residue in $N\overline{K} \to \Sigma(1660) \to \Lambda\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.16 ±0.05	**0 ± 25**	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0614	−84	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

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

Normalized residue in $N\overline{K} \to \Sigma(1660) \to \Sigma\sigma$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.14±0.06	**−150 ± 30**	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel

Normalized residue in $N\overline{K} \to \Sigma(1660) \to \Sigma(1385)\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0513	−44	[1] KAMANO	15	DPWA	Multichannel

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

Normalized residue in $N\overline{K} \to \Sigma(1660) \to \Lambda(1405)\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.06±0.03	**−90 ± 25**	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel

Normalized residue in $N\overline{K} \to \Sigma(1660) \to \Lambda(1520)\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.04±0.02	**5 ± 20**	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel

Σ(1660) MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1640 to 1680 (≈ 1660) OUR ESTIMATE				
1665 ±20	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
1633 ± 3	GAO	12	DPWA	$\overline{K}N \to \Lambda\pi$
1665.1±11.2	[1] KOISO	85	DPWA	$K^- p \to \Sigma\pi$
1670 ±10	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$
1679 ±10	ALSTON-...	78	DPWA	$\overline{K}N \to \overline{K}N$
1668 ±25	VANHORN	75	DPWA	$K^- p \to \Lambda\pi^0$
1670 ±20	KANE	74	DPWA	$K^- p \to \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1676 ±15	GOPAL	77	DPWA	$\overline{K}N$ multichannel
1565 or 1597	[2] MARTIN	77	DPWA	$\overline{K}N$ multichannel
1660 ±30	[3] BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$
1671 ± 2	[4] PONTE	75	DPWA	$K^- p \to \Lambda\pi^0$

[1] The evidence of KOISO 85 is weak.
[2] The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.
[3] From solution 1 of BAILLON 75; not present in solution 2.
[4] From solution 2 of PONTE 75; not present in solution 1.

Σ(1660) WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
100 to 300 (≈ 200) OUR ESTIMATE				
$300\ ^{+140}_{-\ 40}$	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
$121\ ^{+4}_{-7}$	GAO	12	DPWA	$\overline{K}N \to \Lambda\pi$
81.5± 22.2	[1] KOISO	85	DPWA	$K^- p \to \Sigma\pi$
152 ± 20	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$

38 $\pm$ 10	ALSTON-...	78	DPWA $\overline{K}N \rightarrow \overline{K}N$
230 $^{+165}_{-60}$	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
250 $\pm$110	KANE	74	DPWA $K^- p \rightarrow \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
120 $\pm$ 20	GOPAL	77	DPWA $\overline{K}N$ multichannel
202 or 217	[2] MARTIN	77	DPWA $\overline{K}N$ multichannel
80 $\pm$ 40	[3] BAILLON	75	IPWA $\overline{K}N \rightarrow \Lambda\pi$
81 $\pm$ 10	[4] PONTE	75	DPWA $K^- p \rightarrow \Lambda\pi^0$

[1] The evidence of KOISO 85 is weak.
[2] The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.
[3] From solution 1 of BAILLON 75; not present in solution 2.
[4] From solution 2 of PONTE 75; not present in solution 1.

Σ(1660) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\overline{K}$	0.05 to 0.15 ($\approx$ 010)
Γ_2	$\Lambda\pi$	(35 $\pm$12) %
Γ_3	$\Sigma\pi$	(37 $\pm$10) %
Γ_4	$\Sigma\sigma$	(20 $\pm$ 8) %
Γ_5	$\Sigma(1385)\pi$	
Γ_6	$\Lambda(1405)\pi$	(4.0 $\pm$ 2.0) %
Γ_7	$\Lambda(1520)\pi$	

Σ(1660) 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
0.05 to 0.15 (≈ 010) OUR ESTIMATE				
0.07 $\pm$0.03	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
0.12 $\pm$0.03	GOPAL	80	DPWA	$\overline{K}N \rightarrow \overline{K}N$
0.10 $\pm$0.05	ALSTON-...	78	DPWA	$\overline{K}N \rightarrow \overline{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.005	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel
$<$0.04	GOPAL	77	DPWA	See GOPAL 80
0.27 or 0.29	[2] MARTIN	77	DPWA	$\overline{K}N$ multichannel

[1] From the preferred solution A in KAMANO 15.
[2] The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.35 $\pm$0.12	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.128	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.37 ±0.10	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.865	[1] KAMANO	15	DPWA	$\overline{K}N$ multichannel

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

$\Gamma(\Sigma\sigma)/\Gamma_{total}$ — Γ_4/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.20±0.08	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel

$\Gamma(\Sigma(1385)\pi)/\Gamma_{total}$ — Γ_5/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.001	[1] KAMANO	15	DPWA	Multichannel

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

$\Gamma(\Lambda(1405)\pi)/\Gamma_{total}$ — Γ_6/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.04±0.02	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel

$\Gamma(\Lambda(1520)\pi)/\Gamma_{total}$ — Γ_7/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
<0.01	SARANTSEV	19	DPWA	$\overline{K}N$ multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(1660) \to \Lambda\pi$ — $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$-0.064^{+0.005}_{-0.003}$	GAO	12	DPWA	$\overline{K}N \to \Lambda\pi$
< 0.04	GOPAL	77	DPWA	$\overline{K}N$ multichannel
$0.12^{+0.12}_{-0.04}$	VANHORN	75	DPWA	$K^- p \to \Lambda\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.10 or −0.11	[1] MARTIN	77	DPWA	$\overline{K}N$ multichannel
−0.04 ±0.02	[2] BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$
+0.16 ±0.01	[3] PONTE	75	DPWA	$K^- p \to \Lambda\pi^0$

[1] The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.
[2] From solution 1 of BAILLON 75; not present in solution 2.
[3] From solution 2 of PONTE 75; not present in solution 1.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(1660) \to \Sigma\pi$ — $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
−0.13±0.04	[1] KOISO	85	DPWA	$K^- p \to \Sigma\pi$
−0.16±0.03	GOPAL	77	DPWA	$\overline{K}N$ multichannel
−0.11±0.01	KANE	74	DPWA	$K^- p \to \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.34 or −0.37	[2] MARTIN	77	DPWA	$\overline{K}N$ multichannel
not seen	HEPP	76B	DPWA	$K^- N \to \Sigma\pi$

[1] The evidence of KOISO 85 is weak.
[2] The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.

Σ(1660) REFERENCES

SARANTSEV	19	EPJ A55 180	A.V. Sarantsev *et al.*	(BONN, PNPI)	
KAMANO	15	PR C92 025205	H. Kamano *et al.*	(ANL, OSAK)	
GAO	12	PR C86 025201	P. Gao, J. Shi, B.S. Zou	(BHEP, BEIJT)	
Also		NP A867 41	P. Gao, B.S. Zou, A. Sibirtsev	(BHEP, BEIJT+)	
KOISO	85	NP A433 619	H. Koiso *et al.*	(TOKY, MASA)	
PDG	82	PL 111B 1	M. Roos *et al.*	(HELS, CIT, CERN)	
GOPAL	80	Toronto Conf. 159	G.P. Gopal	(RHEL)	IJP
ALSTON-...	78	PR D18 182	M. Alston-Garnjost *et al.*	(LBL, MTHO+)	IJP
Also		PRL 38 1007	M. Alston-Garnjost *et al.*	(LBL, MTHO+)	IJP
GOPAL	77	NP B119 362	G.P. Gopal *et al.*	(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
HEPP	76B	PL 65B 487	V. Hepp *et al.*	(CERN, HEIDH, MPIM)	IJP
BAILLON	75	NP B94 39	P.H. Baillon, P.J. Litchfield	(CERN, RHEL)	IJP
PONTE	75	PR D12 2597	R.A. Ponte *et al.*	(MASA, TENN, UCR)	IJP
VANHORN	75	NP B87 145	A.J. van Horn	(LBL)	IJP
Also		NP B87 157	A.J. van Horn	(LBL)	IJP
KANE	74	LBL-2452	D.F. Kane	(LBL)	IJP