$\Sigma(1750)\ S_{11}$

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

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

There is evidence for this state in many partial-wave analyses, but with wide variations in the mass, width, and couplings. The latest analyses indicated significant couplings to $N\overline{K}$ and $\Lambda\pi$, as well as to $\Sigma\eta$ whose threshold is at 1746 MeV (JONES 74).

Σ(1750) MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
1730 to 1800 (≈ 1750) OUR ESTIMATE				
1756±10	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$
1770±10	ALSTON-...	78	DPWA	$\overline{K}N \to \overline{K}N$
1770±15	GOPAL	77	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1800 or 1813	[1] MARTIN	77	DPWA	$\overline{K}N$ multichannel
1715±10	[2] CARROLL	76	DPWA	Isospin-1 total σ
1730	DEBELLEFON	76	IPWA	$K^- p \to \Lambda\pi^0$
1780±30	BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$ (sol. 1)
1700±30	BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$ (sol. 2)
1697^{+20}_{-10}	VANHORN	75	DPWA	$K^- p \to \Lambda\pi^0$
1785±12	CHU	74	DBC	Fits $\sigma(K^- n \to \Sigma^-\eta)$
1760± 5	[3] JONES	74	HBC	Fits $\sigma(K^- p \to \Sigma^0\eta)$
1739±10	PREVOST	74	DPWA	$K^- N \to \Sigma(1385)\pi$

Σ(1750) WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
60 to 160 (≈ 90) OUR ESTIMATE				
64±10	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$
161±20	ALSTON-...	78	DPWA	$\overline{K}N \to \overline{K}N$
60±10	GOPAL	77	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
117 or 119	[1] MARTIN	77	DPWA	$\overline{K}N$ multichannel
10	[2] CARROLL	76	DPWA	Isospin-1 total σ
110	DEBELLEFON	76	IPWA	$K^- p \to \Lambda\pi^0$
140±30	BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$ (sol. 1)
160±50	BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$ (sol. 2)
66^{+14}_{-12}	VANHORN	75	DPWA	$K^- p \to \Lambda\pi^0$
89±33	CHU	74	DBC	Fits $\sigma(K^- n \to \Sigma^-\eta)$
92± 7	[3] JONES	74	HBC	Fits $\sigma(K^- p \to \Sigma^0\eta)$
108±20	PREVOST	74	DPWA	$K^- N \to \Sigma(1385)\pi$

$\Sigma(1750)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\overline{K}$	10–40 %
Γ_2	$\Lambda\pi$	seen
Γ_3	$\Sigma\pi$	<8 %
Γ_4	$\Sigma\eta$	15–55 %
Γ_5	$\Sigma(1385)\pi$	
Γ_6	$\Lambda(1520)\pi$	

The above branching fractions are our estimates, not fits or averages.

$\Sigma(1750)$ 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
0.1 to 0.4 OUR ESTIMATE				
0.14 ± 0.03	GOPAL	80	DPWA	$\overline{K}N \to \overline{K}N$
0.33 ± 0.05	ALSTON-...	78	DPWA	$\overline{K}N \to \overline{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.15 ± 0.03	GOPAL	77	DPWA	See GOPAL 80
0.06 or 0.05	[1] MARTIN	77	DPWA	$\overline{K}N$ multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(1750) \to \Lambda\pi$ — $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.04 ± 0.03	GOPAL	77	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.10 or -0.09	[1] MARTIN	77	DPWA	$\overline{K}N$ multichannel
-0.12	DEBELLEFON	76	IPWA	$K^- p \to \Lambda\pi^0$
-0.12 ± 0.02	BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$ (sol. 1)
-0.13 ± 0.03	BAILLON	75	IPWA	$\overline{K}N \to \Lambda\pi$ (sol. 2)
-0.13 ± 0.04	VANHORN	75	DPWA	$K^- p \to \Lambda\pi^0$
-0.120 ± 0.077	DEVENISH	74B		Fixed-t dispersion rel.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(1750) \to \Sigma\pi$ — $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
-0.09 ± 0.05	GOPAL	77	DPWA	$\overline{K}N$ multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$+0.06$ or $+0.06$	[1] MARTIN	77	DPWA	$\overline{K}N$ multichannel
0.13 ± 0.02	LANGBEIN	72	IPWA	$\overline{K}N$ multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(1750) \to \Sigma\eta$ — $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.23 ± 0.01	[3] JONES	74	HBC	Fits $\sigma(K^- p \to \Sigma^0\eta)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	CLINE	69	DBC	Threshold bump

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(1750) \rightarrow \Sigma(1385)\pi$ $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.18\pm0.15$	PREVOST	74	DPWA	$K^- N \rightarrow \Sigma(1385)\pi$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(1750) \rightarrow \Lambda(1520)\pi$ $(\Gamma_1\Gamma_6)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.032 ± 0.021	CAMERON	77	DPWA	*P*-wave decay

$\Sigma(1750)$ FOOTNOTES

[1] The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.

[2] A total cross-section bump with $(J+1/2)$ Γ_{el} / Γ_{total} = 0.30.

[3] An *S*-wave Breit-Wigner fit to the threshold cross section with no background and errors statistical only.

$\Sigma(1750)$ REFERENCES

PDG	82	PL 111B	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	77	PRL 38 1007	M. Alston-Garnjost *et al.*	(LBL, MTHO+)	IJP
CAMERON	77	NP B131 399	W. Cameron *et al.*	(RHEL, LOIC)	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	77B	NP B126 266	B.R. Martin, M.K. Pidcock	(LOUC)	
Also	77C	NP B126 285	B.R. Martin, M.K. Pidcock	(LOUC)	IJP
CARROLL	76	PRL 37 806	A.S. Carroll *et al.*	(BNL)	I
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
VANHORN	75	NP B87 145	A.J. van Horn	(LBL)	IJP
Also	75B	NP B87 157	A.J. van Horn	(LBL)	IJP
CHU	74	NC 20A 35	R.Y.L. Chu *et al.*	(PLAT, TUFTS, BRAN)	IJP
DEVENISH	74B	NP B81 330	R.C.E. Devenish, C.D. Froggatt, B.R. Martin	(DESY+)	
JONES	74	NP B73 141	M.D. Jones	(CHIC)	IJP
PREVOST	74	NP B69 246	J. Prevost *et al.*	(SACL, CERN, HEID)	
LANGBEIN	72	NP B47 477	W. Langbein, F. Wagner	(MPIM)	IJP
CLINE	69	LNC 2 407	D. Cline, R. Laumann, J. Mapp	(WISC)	