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

$I(J^P) = 1(\frac{1}{2}^-)$ 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).

$\Sigma(1750)$ 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	$K^-N \to \Sigma(1385)\pi$

$\Sigma(1750)$ 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	$K^-N \to \Sigma(1385)\pi$

Σ(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.

Σ(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	$\overline{K}N \rightarrow \overline{K}N$
0.33±0.05	ALSTON-...	78	DPWA	$\overline{K}N \rightarrow \overline{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.15±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 $N\overline{K} \rightarrow \Sigma(1750) \rightarrow \Lambda\pi$ $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

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	$K^-p \rightarrow \Lambda\pi^0$
−0.12 ±0.02	BAILLON	75	IPWA	$\overline{K}N \rightarrow \Lambda\pi$ (sol. 1)
−0.13 ±0.03	BAILLON	75	IPWA	$\overline{K}N \rightarrow \Lambda\pi$ (sol. 2)
−0.13 ±0.04	VANHORN	75	DPWA	$K^-p \rightarrow \Lambda\pi^0$
−0.120±0.077	DEVENISH	74B		Fixed-t dispersion rel.

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

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 $N\overline{K} \rightarrow \Sigma(1750) \rightarrow \Sigma\eta$ $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.23±0.01	[3] JONES	74	HBC	Fits $\sigma(K^-p \rightarrow \Sigma^0\eta)$
• • • 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 $N\overline{K} \to \Sigma(1750) \to \Sigma(1385)\pi$ $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.18 \pm 0.15$	PREVOST	74	DPWA	$K^- N \to \Sigma(1385)\pi$

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

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 $(J+1/2)\ \Gamma_{el}\ /\ \Gamma_{total} = 0.30$.

[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		Roos, Porter, Aguilar-Benitez+	(HELS, CIT, CERN)
GOPAL	80	Toronto Conf. 159			(RHEL) IJP
ALSTON-...	78	PR D18 182		Alston-Garnjost, Kenney+	(LBL, MTHO, CERN) IJP
Also	77	PRL 38 1007		Alston-Garnjost, Kenney+	(LBL, MTHO, CERN) IJP
CAMERON	77	NP B131 399		+Franek, Gopal, Kalmus, McPherson+	(RHEL, LOIC) IJP
GOPAL	77	NP B119 362		+Ross, VanHorn, McPherson+	(LOIC, RHEL) IJP
MARTIN	77	NP B127 349		+Pidcock, Moorhouse	(LOUC, GLAS) IJP
Also	77B	NP B126 266		Martin, Pidcock	(LOUC)
Also	77C	NP B126 285		Martin, Pidcock	(LOUC) IJP
CARROLL	76	PRL 37 806		+Chiang, Kycia, Li, Mazur, Michael+	(BNL) I
DEBELLEFON	76	NP B109 129		De Bellefon, Berthon	(CDEF) IJP
BAILLON	75	NP B94 39		+Litchfield	(CERN, RHEL) IJP
VANHORN	75	NP B87 145			(LBL) IJP
Also	75B	NP B87 157		VanHorn	(LBL) IJP
CHU	74	NC 20A 35		+Bartley+	(PLAT, TUFTS, BRAN) IJP
DEVENISH	74B	NP B81 330		+Froggatt, Martin	(DESY, NORD, LOUC)
JONES	74	NP B73 141			(CHIC) IJP
PREVOST	74	NP B69 246		+Barloutaud+	(SACL, CERN, HEID)
LANGBEIN	72	NP B47 477		+Wagner	(MPIM) IJP
CLINE	69	LNC 2 407		+Laumann, Mapp	(WISC)