$\Sigma(1670)$ Bumps

$I(J^P) = 1(?^?)$

OMITTED FROM SUMMARY TABLE

Formation experiments are listed separately in the preceding entry.

Probably there are two states at the same mass with the same quantum numbers, one decaying to $\Sigma\pi$ and $\Lambda\pi$, the other to $\Lambda(1405)\pi$. See the note in front of the preceding entry.

$\Sigma(1670)$ MASS (PRODUCTION EXPERIMENTS)

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
≈ 1670 OUR ESTIMATE						
1670± 4		[1] CARROLL	76	DPWA		Isospin-1 total σ
1675±10		[2] HEPP	76	DBC	−	$K^- N$ 1.6–1.75 GeV/c
1665± 1		APSELL	74	HBC		$K^- p$ 2.87 GeV/c
1688± 2 or 1683 ± 5	1200	BERTHON	74	HBC	0	Quasi-2-body σ
1670± 6		AGUILAR-...	70B	HBC		$K^- p \rightarrow \Sigma\pi\pi$ 4 GeV
1668±10		AGUILAR-...	70B	HBC		$K^- p \rightarrow \Sigma 3\pi$ 4 GeV
1660±10		ALVAREZ	63	HBC	+	$K^- p$ 1.51 GeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1668±10	150	[3] FERRERSORIA	81	OMEG	−	$\pi^- p$ 9,12 GeV/c
1655 to 1677		TIMMERMANS	76	HBC	+	$K^- p$ 4.2 GeV/c
1665± 5		BUGG	68	CNTR		$K^- p$, d total σ
1661± 9	70	PRIMER	68	HBC	+	See BARNES 69E
1685		ALEXANDER	62C	HBC	−0	$\pi^- p$ 2–2.2 GeV/c

$\Sigma(1670)$ WIDTH (PRODUCTION EXPERIMENTS)

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
67.0± 2.4		APSELL	74	HBC		$K^- p$ 2.87 GeV/c
110 ±12		AGUILAR-...	70B	HBC		$K^- p \rightarrow \Sigma\pi\pi$ 4 GeV
135 $^{+40}_{-30}$		AGUILAR-...	70B	HBC		$K^- p \rightarrow \Sigma 3\pi$ 4 GeV
40 ±10		ALVAREZ	63	HBC	+	

• • • We do not use the following data for averages, fits, limits, etc. • • •

90	±20	150	[3] FERRERSORIA	81	OMEG	−	$\pi^- p$ 9,12 GeV/c
52			[1] CARROLL	76	DPWA		Isospin-1 total σ
48	to 63		TIMMERMANS	76	HBC	+	$K^- p$ 4.2 GeV/c
30	±15		BUGG	68	CNTR		
60	±20	70	PRIMER	68	HBC	+	See BARNES 69E
45			ALEXANDER	62C	HBC	−0	

Σ(1670) DECAY MODES (PRODUCTION EXPERIMENTS)

	Mode
Γ_1	$N\overline{K}$
Γ_2	$\Lambda\pi$
Γ_3	$\Sigma\pi$
Γ_4	$\Lambda\pi\pi$
Γ_5	$\Sigma\pi\pi$
Γ_6	$\Sigma(1385)\pi$
Γ_7	$\Lambda(1405)\pi$

Σ(1670) BRANCHING RATIOS (PRODUCTION EXPERIMENTS)

$\Gamma(N\overline{K})/\Gamma(\Sigma\pi)$ — Γ_1/Γ_3

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
<0.03		TIMMERMANS	76	HBC	+	$K^- p$ 4.2 GeV/c
<0.10		BERTHON	74	HBC	0	Quasi-2-body σ
<0.2		AGUILAR-...	70B	HBC		
<0.26		BARNES	69E	HBC	+	$K^- p$ 3.9–5 GeV/c
0.025		BUGG	68	CNTR	0	Assuming $J = 3/2$
<0.24	0	PRIMER	68	HBC	+	$K^- p$ 4.6–5 GeV/c
<0.6		LONDON	66	HBC	+	$K^- p$ 2.25 GeV/c
<0.19	0	ALVAREZ	63	HBC	+	$K^- p$ 1.15 GeV/c
≥ 0.5 ±0.25		SMITH	63	HBC	−0	

$\Gamma(\Lambda\pi)/\Gamma(\Sigma\pi)$ — Γ_2/Γ_3

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
0.76±0.09		ESTES	74	HBC	0	$K^- p$ 2.1,2.6 GeV/c
0.45±0.15		BARNES	69E	HBC	+	$K^- p$ 3.9–5 GeV/c
0.15±0.07		HUWE	69	HBC	+	
0.11±0.06	33	BUTTON-...	68	HBC	+	$K^- p$ 1.7 GeV/c

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\leq 0.45\pm0.07$		TIMMERMANS	76	HBC	+	$K^- p$ 4.2 GeV/c
0.55 ± 0.11		BERTHON	74	HBC	0	Quasi-2-body σ
0	0	PRIMER	68	HBC	+	See BARNES 69E
<0.6		LONDON	66	HBC	+	$K^- p$ 2.25 GeV/c
1.2	130	ALVAREZ	63	HBC	+	$K^- p$ 1.15 GeV/c
1.2		SMITH	63	HBC	−0	

$\Gamma(\Lambda\pi\pi)/\Gamma(\Sigma\pi)$ Γ_4/Γ_3

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
<0.6		LONDON	66	HBC	+	$K^- p$ 2.25 GeV/c
0.56	90	ALVAREZ	63	HBC	+	$K^- p$ 1.15 GeV/c
0.17		SMITH	63	HBC	−0	

$\Gamma(\Sigma\pi\pi)/\Gamma(\Sigma\pi)$ Γ_5/Γ_3

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
largest at small angles		ESTES	74	HBC	0	$K^- p$ 2.1,2.6 GeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.2		[2] HEPP	76	DBC	−	$K^- N$ 1.6–1.75 GeV/c
0.56	180	ALVAREZ	63	HBC	+	$K^- p$ 1.15 GeV/c

$\Gamma(\Lambda(1405)\pi)/\Gamma(\Sigma\pi)$ Γ_7/Γ_3

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
$1.8\ \pm0.3$ to 0.02 ± 0.07		[3,4] TIMMERMANS	76	HBC	+	$K^- p$ 4.2 GeV/c
largest at small angles		ESTES	74	HBC	$\pm$	$K^- p$ 2.1,2.6 GeV/c
$3.0\ \pm1.6$	50	LONDON	66	HBC	+	$K^- p$ 2.25 GeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.58 ± 0.20	17	PRIMER	68	HBC	+	See BARNES 69E

$\Gamma(\Sigma\pi)/\Gamma(\Sigma\pi\pi)$ Γ_3/Γ_5

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
varies with prod. angle	[5] APSELL	74	HBC	+	$K^- p$ 2.87 GeV/c
1.39 ± 0.16	BERTHON	74	HBC	0	Quasi-2-body σ
2.5 to 0.24	[4] EBERHARD	69	HBC		$K^- p$ 2.6 GeV/c
<0.4	BIRMINGHAM	66	HBC	+	$K^- p$ 3.5 GeV/c
0.30 ± 0.15	LONDON	66	HBC	+	$K^- p$ 2.25 GeV/c

$\Gamma(\Lambda(1405)\pi)/\Gamma(\Sigma\pi\pi)$ Γ_7/Γ_5

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.97 ± 0.08	TIMMERMANS	76	HBC		$K^- p$ 4.2 GeV/c
1.00 ± 0.02	APSELL	74	HBC		$K^- p$ 2.87 GeV/c
$0.90^{+0.10}_{-0.16}$	EBERHARD	65	HBC	+	$K^- p$ 2.45 GeV/c

$\Gamma(\Lambda(1405)\pi)/\Gamma(\Sigma(1385)\pi)$ Γ_7/Γ_6

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
<0.8	EBERHARD	65	HBC	+	$K^- p$ 2.45 GeV/c

$\Gamma(\Lambda\pi\pi)/\Gamma(\Sigma\pi\pi)$ — Γ_4/Γ_5

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.35 ± 0.2	BIRMINGHAM	66	HBC	$+$	$K^- p$ 3.5 GeV/c

$\Gamma(\Lambda\pi)/\Gamma(\Sigma\pi\pi)$ — Γ_2/Γ_5

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
<0.2	BIRMINGHAM	66	HBC	$+$	$K^- p$ 3.5 GeV/c

$\Gamma(\Lambda\pi)/[\Gamma(\Lambda\pi)+\Gamma(\Sigma\pi)]$ — $\Gamma_2/(\Gamma_2+\Gamma_3)$

VALUE	DOCUMENT ID		TECN
<0.6	AGUILAR-...	70B	HBC

$\Gamma(\Sigma(1385)\pi)/\Gamma(\Sigma\pi)$ — Γ_6/Γ_3

VALUE	DOCUMENT ID		TECN	COMMENT
$\leq 0.21\pm0.05$	TIMMERMANS	76	HBC	$K^- p$ 4.2 GeV/c

$\Sigma(1670)$ QUANTUM NUMBERS (PRODUCTION EXPERIMENTS)

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
$J^P = 3/2^-$	400	BUTTON-...	68	HBC	$\pm$	$\Sigma^0\pi$
$J^P = 3/2^-$		EBERHARD	67	HBC	$+$	$\Lambda(1405)\pi$
$J^P = 3/2^+$		LEVEQUE	65	HBC		$\Lambda(1405)\pi$

$\Sigma(1670)$ FOOTNOTES

[1] Total cross-section bump with $(J+1/2)\ \Gamma_{el}\ /\ \Gamma_{total} = 0.23$.
[2] Enhancements in $\Sigma\pi$ and $\Sigma\pi\pi$ cross sections.
[3] Backward production in the $\Lambda\pi^- K^+$ final state.
[4] Depending on production angle.
[5] APSELL 74, ESTES 74, and TIMMERMANS 76 find strong branching ratio dependence on production angle, as in earlier production experiments.

$\Sigma(1670)$ REFERENCES (PRODUCTION EXPERIMENTS)

FERRERSORIA	81	NP B178 373	A. Ferrer Soria *et al.*	(CERN, CDEF, EPOL+)	
CARROLL	76	PRL 37 806	A.S. Carroll *et al.*	(BNL)	I
HEPP	76	NP B115 82	V. Hepp *et al.*	(CERN, HEID, MPIM)	I
TIMMERMANS	76	NP B112 77	J.J.M. Timmermans *et al.*	(NIJM, CERN+)	JP
APSELL	74	PR D10 1419	S.P. Apsell *et al.*	(BRAN, UMD, SYRA+)	I
BERTHON	74	NC 21A 146	A. Berthon *et al.*	(CDEF, RHEL, SACL+)	
ESTES	74	Thesis LBL-3827	R.D. Estes	(LBL)	
AGUILAR-...	70B	PRL 25 58	M. Aguilar-Benitez *et al.*	(BNL, SYRA)	
BARNES	69E	BNL 13823	V.E. Barnes *et al.*	(BNL, SYRA)	
EBERHARD	69	PRL 22 200	P.H. Eberhard *et al.*	(LRL)	
HUWE	69	PR 180 1824	D.O. Huwe	(LRL)	

BUGG	68	PR 168 1466	D.V. Bugg *et al.*	(RHEL, BIRM, CAVE) I
BUTTON-...	68	PRL 21 1123	J. Button-Shafer	(MASA, LRL) JP
PRIMER	68	PRL 20 610	M. Primer *et al.*	(SYRA, BNL)
EBERHARD	67	PR 163 1446	P. Eberhard *et al.*	(LRL, ILL) IJP
BIRMINGHAM	66	PR 152 1148	M. Haque *et al.*	(BIRM, GLAS, LOIC, OXF+)
LONDON	66	PR 143 1034	G.W. London *et al.*	(BNL, SYRA) IJ
EBERHARD	65	PRL 14 466	P.H. Eberhard *et al.*	(LRL, ILL) I
LEVEQUE	65	PL 18 69	A. Leveque *et al.*	(SACL, EPOL, GLAS+) JP
ALVAREZ	63	PRL 10 184	L.W. Alvarez *et al.*	(LRL) I
SMITH	63	Athens Conf. 67	G.A. Smith	(LRL)
ALEXANDER	62C	CERN Conf. 320	G. Alexander *et al.*	(LRL) I