

$\Sigma(2030) F_{17}$ $I(J^P) = 1(\frac{7}{2}^+)$ 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** (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** No. 2 Pt. II (1984).

 $\Sigma(2030)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2025 to 2040 (\approx 2030) OUR ESTIMATE			
2036 \pm 5	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
2038 \pm 10	CORDEN	77B	$K^- N \rightarrow N\bar{K}^*$
2040 \pm 5	GOPAL	77	DPWA $\bar{K}N$ multichannel
2030 \pm 3	¹ CORDEN	76	DPWA $K^- n \rightarrow \Lambda\pi^-$
2035 \pm 15	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$
2038 \pm 10	HEMINGWAY	75	DPWA $K^- p \rightarrow \bar{K}N$
2042 \pm 11	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
2020 \pm 6	KANE	74	DPWA $K^- p \rightarrow \Sigma\pi$
2035 \pm 10	LITCHFIELD	74B	DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$
2020 \pm 30	LITCHFIELD	74C	DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$
2025 \pm 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 $K^- p \rightarrow \Lambda\pi^0$

 $\Sigma(2030)$ WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
150 to 200 (\approx 180) OUR ESTIMATE			
172 \pm 10	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
137 \pm 40	CORDEN	77B	$K^- N \rightarrow N\bar{K}^*$
190 \pm 10	GOPAL	77	DPWA $\bar{K}N$ multichannel
201 \pm 9	¹ CORDEN	76	DPWA $K^- n \rightarrow \Lambda\pi^-$
180 \pm 20	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$
172 \pm 15	HEMINGWAY	75	DPWA $K^- p \rightarrow \bar{K}N$
178 \pm 13	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
111 \pm 5	KANE	74	DPWA $K^- p \rightarrow \Sigma\pi$
160 \pm 20	LITCHFIELD	74B	DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$
200 \pm 30	LITCHFIELD	74C	DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$

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

260	DECLAIS	77	DPWA	$\bar{K}N \rightarrow \bar{K}N$
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	$K^- p \rightarrow \Lambda(1820) \pi^0$

$\Sigma(2030)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\bar{K}$	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 $\Sigma(1385)\pi$, <i>F-wave</i>	
Γ_7 $\Lambda(1520)\pi$	10–20 %
Γ_8 $\Lambda(1520)\pi$, <i>D-wave</i>	
Γ_9 $\Lambda(1520)\pi$, <i>G-wave</i>	
Γ_{10} $\Delta(1232)\bar{K}$	10–20 %
Γ_{11} $\Delta(1232)\bar{K}$, <i>F-wave</i>	
Γ_{12} $\Delta(1232)\bar{K}$, <i>H-wave</i>	
Γ_{13} $N\bar{K}^*(892)$	<5 %
Γ_{14} $N\bar{K}^*(892)$, <i>S=1/2, F-wave</i>	
Γ_{15} $N\bar{K}^*(892)$, <i>S=3/2, F-wave</i>	
Γ_{16} $\Lambda(1820)\pi$, <i>P-wave</i>	

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

$\Sigma(2030)$ BRANCHING RATIOS

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

$\Gamma(N\bar{K})/\Gamma_{\text{total}}$				Γ_1/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.17 to 0.23 OUR ESTIMATE				
0.19±0.03	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$	
0.18±0.03	HEMINGWAY	75	DPWA $K^- p \rightarrow \bar{K}N$	
••• We do not use the following data for averages, fits, limits, etc. •••				
0.15	DECLAIS	77	DPWA $\bar{K}N \rightarrow \bar{K}N$	
0.24±0.02	GOPAL	77	DPWA See GOPAL 80	

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Lambda\pi$				$(\Gamma_1 \Gamma_2)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
+0.18 ± 0.02	GOPAL	77	DPWA	$\bar{K}N$ multichannel
+0.20 ± 0.01	¹ CORDEN	76	DPWA	$K^- n \rightarrow \Lambda\pi^-$
+0.18 ± 0.02	BAILLON	75	IPWA	$\bar{K}N \rightarrow \Lambda\pi$
+0.20 ± 0.01	VANHORN	75	DPWA	$K^- p \rightarrow \Lambda\pi^0$
+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	$K^- p \rightarrow \Lambda\pi^0$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Sigma\pi$				$(\Gamma_1 \Gamma_3)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
-0.09 ± 0.01	² CORDEN	77C		$K^- n \rightarrow \Sigma\pi$
-0.06 ± 0.01	² CORDEN	77C		$K^- n \rightarrow \Sigma\pi$
-0.15 ± 0.03	GOPAL	77	DPWA	$\bar{K}N$ multichannel
-0.10 ± 0.01	KANE	74	DPWA	$K^- p \rightarrow \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.085 ± 0.02	³ GOYAL	77	DPWA	$K^- N \rightarrow \Sigma\pi$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Xi K$				$(\Gamma_1 \Gamma_4)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
0.023	MULLER	69B	DPWA	$K^- p \rightarrow \Xi K$
<0.05	BURGUN	68	DPWA	$K^- p \rightarrow \Xi K$
<0.05	TRIPP	67	RVUE	$K^- p \rightarrow \Xi K$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Lambda(1820)\pi$, P -wave				$(\Gamma_1 \Gamma_{16})^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
0.14 ± 0.02	CORDEN	75B	DBC	$K^- n \rightarrow N\bar{K}\pi^-$
0.18 ± 0.04	LITCHFIELD	74D	DPWA	$K^- p \rightarrow \Lambda(1820)\pi^0$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Lambda(1520)\pi$, D -wave				$(\Gamma_1 \Gamma_8)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
+0.114 ± 0.010	⁴ CAMERON	77	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$
0.14 ± 0.03	LITCHFIELD	74B	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.10 ± 0.03	⁵ CORDEN	75B	DBC	$K^- n \rightarrow N\bar{K}\pi^-$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Lambda(1520)\pi$, G -wave				$(\Gamma_1 \Gamma_9)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
+0.146 ± 0.010	⁴ CAMERON	77	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$
0.02 ± 0.02	LITCHFIELD	74B	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Delta(1232)\bar{K}$, F -wave				$(\Gamma_1 \Gamma_{11})^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
0.16 ± 0.03	LITCHFIELD	74C	DPWA	$K^- p \rightarrow \Delta(1232)\bar{K}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.17 ± 0.03	⁵ CORDEN	75B	DBC	$K^- n \rightarrow N\bar{K}\pi^-$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Delta(1232)\bar{K}$, *H-wave* $(\Gamma_1 \Gamma_{12})^{1/2} / \Gamma$

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

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Sigma(1385)\pi$ $(\Gamma_1 \Gamma_5)^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
$+0.153 \pm 0.026$	⁴ CAMERON	78	DPWA $K^- p \rightarrow \Sigma(1385)\pi$

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

$(\Gamma_1 \Gamma_{14})^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
$+0.06 \pm 0.03$	⁴ CAMERON	78B	DPWA $K^- p \rightarrow N\bar{K}^*$
-0.02 ± 0.01	CORDEN	77B	$K^- d \rightarrow NN\bar{K}^*$

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

$(\Gamma_1 \Gamma_{15})^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
$+0.04 \pm 0.03$	⁶ CAMERON	78B	DPWA $K^- p \rightarrow N\bar{K}^*$
-0.12 ± 0.02	CORDEN	77B	$K^- d \rightarrow NN\bar{K}^*$

$\Sigma(2030)$ FOOTNOTES

- ¹ Preferred solution 3; see CORDEN 76 for other possibilities.
- ² The two entries for CORDEN 77C are from two different acceptable solutions.
- ³ This coupling is extracted from unnormalized data.
- ⁴ The published sign has been changed to be in accord with the baryon-first convention.
- ⁵ An upper limit.
- ⁶ The upper limit on the G_3 wave is 0.03.

$\Sigma(2030)$ REFERENCES

PDG	84	RMP 56 No. 2 Pt. II	Wohl, Cahn, Rittenberg+	(LBL, CIT, CERN)
PDG	82	PL 111B	Roos, Porter, Aguilar-Benitez+	(HELS, CIT, CERN)
GOPAL	80	Toronto Conf. 159		(RHEL) IJP
CAMERON	78	NP B143 189	+Franeek, Gopal, Bacon, Butterworth+	(RHEL, LOIC) IJP
CAMERON	78B	NP B146 327	+Franeek, Gopal, Kalmus, McPherson+	(RHEL, LOIC) IJP
CAMERON	77	NP B131 399	+Franeek, Gopal, Kalmus, McPherson+	(RHEL, LOIC) IJP
CORDEN	77B	NP B121 365	+Cox, Kenyon, O'Neale, Stubbs, Sumorok+	(BIRM) IJP
CORDEN	77C	NP B125 61	+Cox, Kenyon, O'Neale, Stubbs, Sumorok+	(BIRM) IJP
DECLAIS	77	CERN 77-16	+Duchon, Louvel, Patry, Seguinot+	(CAEN, CERN) IJP
GOPAL	77	NP B119 362	+Ross, VanHorn, McPherson+	(LOIC, RHEL) IJP
GOYAL	77	PR D16 2746	+Sodhi	(DELH) IJP
CORDEN	76	NP B104 382	+Cox, Dartnell, Kenyon, O'Neale+	(BIRM) IJP
DEBELLEFON	76	NP B109 129	De Bellefon, Berthon	(CDEF) IJP
BAILLON	75	NP B94 39	+Litchfield	(CERN, RHEL) IJP

CORDEN	75B	NP B92 365	+Cox, Dartnell, Kenyon, O'Neale+	(BIRM) IJP
HEMINGWAY	75	NP B91 12	+Eades, Harmsen+	(CERN, HEIDH, MPIM) IJP
VANHORN	75	NP B87 145		(LBL) IJP
Also	75B	NP B87 157	VanHorn	(LBL) IJP
DEVENISH	74B	NP B81 330	+Froggatt, Martin	(DESY, NORD, LOUC)
KANE	74	LBL-2452		(LBL) IJP
LITCHFIELD	74B	NP B74 19	+Hemingway, Baillon+	(CERN, HEIDH) IJP
LITCHFIELD	74C	NP B74 39	+Hemingway, Baillon+	(CERN, HEIDH) IJP
LITCHFIELD	74D	NP B74 12	+Hemingway, Baillon+	(CERN, HEIDH) IJP
MULLER	69B	Thesis UCRL 19372		(LRL)
BURGUN	68	NP B8 447	+Meyer, Pauli, Tallini+	(SACL, CDEF, RHEL)
TRIPP	67	NP B3 10	+Leith+	(LRL, SLAC, CERN, HEID, SACL)
COOL	66	PRL 16 1228	+Giacomelli, Kycia, Leontic, Lundby+	(BNL)
WOHL	66	PRL 17 107	+Solmitz, Stevenson	(LRL) IJP
