

# $\Sigma(1385) P_{13}$

$$I(J^P) = 1(\frac{3}{2}^+) \text{ Status: } ****$$

Discovered by ALSTON 60. Early measurements of the mass and width for combined charge states have been omitted. They may be found in our 1984 edition Reviews of Modern Physics **56** No. 2 Pt. II (1984).

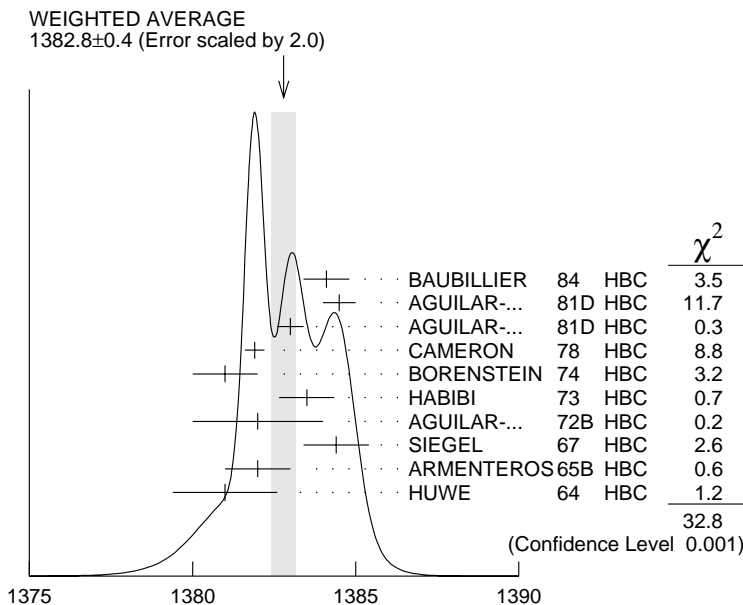
We average only the most significant determinations. We do not average results from inclusive experiments with large backgrounds or results which are not accompanied by some discussion of experimental resolution. Nevertheless systematic differences between experiments remain. (See the ideograms in the Listings below.) These differences could arise from interference effects that change with production mechanism and/or beam momentum. They can also be accounted for in part by differences in the parametrizations employed. (See BORENSTEIN 74 for a discussion on this point.) Thus BORENSTEIN 74 uses a Breit-Wigner with energy-independent width, since a  $P$ -wave was found to give unsatisfactory fits. CAMERON 78 uses the same form. On the other hand HOLMGREN 77 obtains a good fit to their  $\Lambda\pi$  spectrum with a  $P$ -wave Breit-Wigner, but includes the partial width for the  $\Sigma\pi$  decay mode in the parametrization. AGUILAR-BENITEZ 81D gives masses and widths for five different Breit-Wigner shapes. The results vary considerably. Only the best-fit  $S$ -wave results are given here.

## $\Sigma(1385)$ MASSES

### $\Sigma(1385)^+$ MASS

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1382.8 ± 0.4</b>	<b>OUR AVERAGE</b>	Error includes scale factor of 2.0. See the ideogram below.		
1384.1 ± 0.7	1897	BAUBILLIER 84	HBC	$K^- p$ 8.25 GeV/c
1384.5 ± 0.5	5256	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda\pi\pi$ 4.2 GeV/c
1383.0 ± 0.4	9361	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda 3\pi$ 4.2 GeV/c
1381.9 ± 0.3	6900	CAMERON 78	HBC	$K^- p$ 0.96–1.36 GeV/c
1381 ± 1	6846	BORENSTEIN 74	HBC	$K^- p$ 2.18 GeV/c
1383.5 ± 0.85	2300	HABIBI 73	HBC	$K^- p \rightarrow \Lambda\pi\pi$
1382 ± 2	400	AGUILAR-...	72B HBC	$K^- p \rightarrow \Lambda\pi$ 's
1384.4 ± 1.0	1260	SIEGEL 67	HBC	$K^- p$ 2.1 GeV/c
1382 ± 1	750	ARMENTEROS65B	HBC	$K^- p$ 0.9–1.2 GeV/c
1381.0 ± 1.6	859	HUWE 64	HBC	$K^- p$ 1.22 GeV/c
• • •		We do not use the following data for averages, fits, limits, etc. • • •		
1385.1 ± 1.2	600	BAKER 80	HYBR	$\pi^+ p$ 7 GeV/c
1383.2 ± 1.0	750	BAKER 80	HYBR	$K^- p$ 7 GeV/c
1381 ± 2	7k	<sup>1</sup> BAUBILLIER 79B	HBC	$K^- p$ 8.25 GeV/c
1391 ± 2	2k	CAUTIS 79	HYBR	$\pi^+ p / K^- p$ 11.5 GeV
1390 ± 2	100	<sup>1</sup> SUGAHARA 79B	HBC	$\pi^- p$ 6 GeV/c
1385 ± 3	22k	<sup>1,2</sup> BARREIRO 77B	HBC	$K^- p$ 4.2 GeV/c

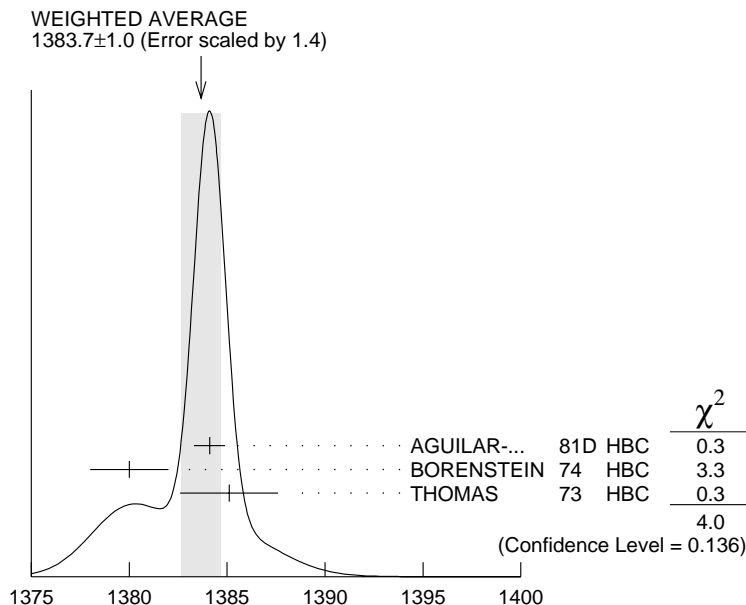
1385 ±1	2594	HOLMGREN	77	HBC	See AGUILAR 81D
1380 ±2		1 BARDADIN-...	75	HBC	$K^- p$ 14.3 GeV/c
1382 ±1	3740	3 BERTHON	74	HBC	$K^- p$ 1263–1843 MeV/c
1390 ±6	46	AGUILAR-...	70B	HBC	$K^- p \rightarrow \Sigma \pi$ 's 4 GeV/c
1383 ±8	62	4 BIRMINGHAM	66	HBC	$K^- p$ 3.5 GeV/c
1378 ±5	135	LONDON	66	HBC	$K^- p$ 2.24 GeV/c
1384.3±1.9	250	4 SMITH	65	HBC	$K^- p$ 1.8 GeV/c
1382.6±2.1	250	4 SMITH	65	HBC	$K^- p$ 1.95 GeV/c
1375.0±3.9	170	COOPER	64	HBC	$K^- p$ 1.45 GeV/c
1376.0±3.9	154	4 ELY	61	HLBC	$K^- p$ 1.11 GeV/c



$\Sigma(1385)^+$  mass (MeV)

### $\Sigma(1385)^0$ MASS

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1383.7±1.0 OUR AVERAGE</b>		Error includes scale factor of 1.4.		See the ideogram below.
1384.1±0.8	5722	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda 3\pi$ 4.2 GeV/c
1380 ±2	3100	5 BORENSTEIN	74 HBC	$K^- p \rightarrow \Lambda 3\pi$ 2.18 GeV/c
1385.1±2.5	240	4 THOMAS	73 HBC	$\pi^- p \rightarrow \Lambda \pi^0 K^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1389 ±3	500	6 BAUBILLIER	79B HBC	$K^- p$ 8.25 GeV/c

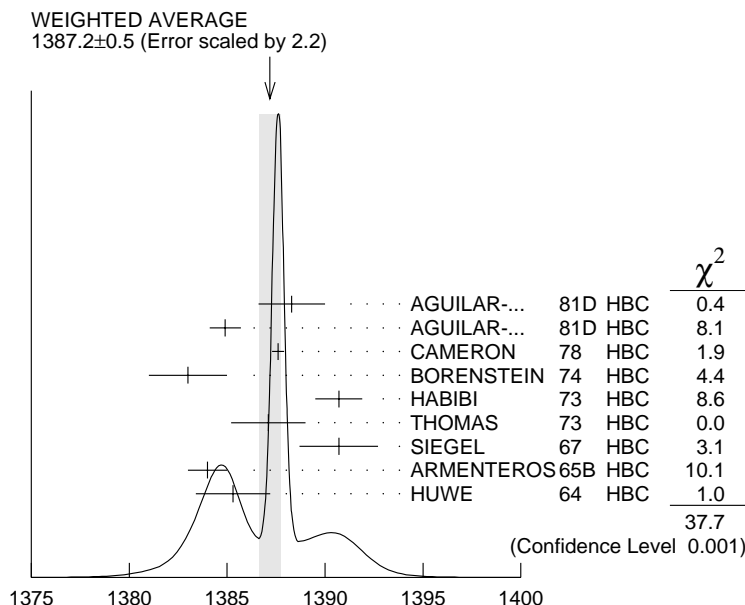


$\Sigma(1385)^0$  mass (MeV)

**$\Sigma(1385)^-$  MASS**

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1387.2±0.5 OUR AVERAGE</b>		Error includes scale factor of 2.2.		See the ideogram below.
1388.3±1.7	620	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda \pi \pi$ 4.2 GeV/c
1384.9±0.8	3346	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda 3\pi$ 4.2 GeV/c
1387.6±0.3	9720	CAMERON	78 HBC	$K^- p$ 0.96–1.36 GeV/c
1383 ±2	2303	BORENSTEIN	74 HBC	$K^- p$ 2.18 GeV/c
1390.7±1.2	1900	HABIBI	73 HBC	$K^- p \rightarrow \Lambda \pi \pi$
1387.1±1.9	630	<sup>4</sup> THOMAS	73 HBC	$\pi^- p \rightarrow \Lambda \pi^- K^+$
1390.7±2.0	370	SIEGEL	67 HBC	$K^- p$ 2.1 GeV/c
1384 ±1	1380	ARMENTEROS65B	HBC	$K^- p$ 0.9–1.2 GeV/c
1385.3±1.9	1086	<sup>4</sup> HUWE	64 HBC	$K^- p$ 1.15–1.30 GeV/c
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1383 ±1	4.5k	<sup>1</sup> BAUBILLIER	79B HBC	$K^- p$ 8.25 GeV/c
1380 ±6	150	<sup>1</sup> SUGAHARA	79B HBC	$\pi^- p$ 6 GeV/c
1387 ±3	12k	<sup>1,2</sup> BARREIRO	77B HBC	$K^- p$ 4.2 GeV/c
1391 ±3	193	HOLMGREN	77 HBC	See AGUILAR 81D
1383 ±2		<sup>1</sup> BARDADIN-...	75 HBC	$K^- p$ 14.3 GeV/c
1389 ±1	3060	<sup>3</sup> BERTHON	74 HBC	$K^- p$ 1263–1843 MeV/c
1389 ±9	15	LONDON	66 HBC	$K^- p$ 2.24 GeV/c
1391.5±2.6	120	<sup>4</sup> SMITH	65 HBC	$K^- p$ 1.8 GeV/c
1399.8±2.2	58	<sup>4</sup> SMITH	65 HBC	$K^- p$ 1.95 GeV/c

1392.0 ± 6.2	200	COOPER	64	HBC	$K^- p$ 1.45 GeV/c
1382 ± 3	93	DAHL	61	DBC	$K^- d$ 0.45 GeV/c
1376.0 ± 4.4	224	<sup>4</sup> ELY	61	HLBC	$K^- p$ 1.11 GeV/c



$\Sigma(1385)^-$  mass (MeV)

$m_{\Sigma(1385)^-} - m_{\Sigma(1385)^+}$

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
- 2 to +6	95	<sup>7</sup> BORENSTEIN 74	HBC	$K^- p$ 2.18 GeV/c
7.2 ± 1.4		<sup>7</sup> HABIBI 73	HBC	$K^- p \rightarrow \Lambda \pi \pi$
6.3 ± 2.0		<sup>7</sup> SIEGEL 67	HBC	$K^- p$ 2.1 GeV/c
11 ± 9		<sup>7</sup> LONDON 66	HBC	$K^- p$ 2.24 GeV/c
9 ± 6		LONDON 66	HBC	$\Lambda 3\pi$ events
2.0 ± 1.5		<sup>7</sup> ARMENTEROS65B	HBC	$K^- p$ 0.9-1.2 GeV/c
7.2 ± 2.1		<sup>7</sup> SMITH 65	HBC	$K^- p$ 1.8 GeV/c
17.2 ± 2.0		<sup>7</sup> SMITH 65	HBC	$K^- p$ 1.95 GeV/c
17 ± 7		<sup>7</sup> COOPER 64	HBC	$K^- p$ 1.45 GeV/c
4.3 ± 2.2		<sup>7</sup> HUWE 64	HBC	$K^- p$ 1.22 GeV/c
0.0 ± 4.2		<sup>7</sup> ELY 61	HLBC	$K^- p$ 1.11 GeV/c

$m_{\Sigma(1385)^0} - m_{\Sigma(1385)^+}$

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
- 4 to +4	95	<sup>7</sup> BORENSTEIN 74	HBC	$K^- p$ 2.18 GeV/c

$m_{\Sigma(1385)^-} - m_{\Sigma(1385)^0}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2.0 ± 2.4	<sup>7</sup> THOMAS	73 HBC	$\pi^- p \rightarrow \Lambda \pi^- K^+$

**$\Sigma(1385)$  WIDTHS**

**$\Sigma(1385)^+$  WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>35.8 ± 0.8 OUR AVERAGE</b>				
37.2 ± 2.0	1897	BAUBILLIER	84 HBC	$K^- p$ 8.25 GeV/c
35.1 ± 1.7	5256	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda \pi \pi$ 4.2 GeV/c
37.5 ± 2.0	9361	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda 3\pi$ 4.2 GeV/c
35.5 ± 1.9	6900	CAMERON	78 HBC	$K^- p$ 0.96–1.36 GeV/c
34.0 ± 1.6	6846	<sup>8</sup> BORENSTEIN	74 HBC	$K^- p$ 2.18 GeV/c
38.3 ± 3.2	2300	<sup>9</sup> HABIBI	73 HBC	$K^- p \rightarrow \Lambda \pi \pi$
32.5 ± 6.0	400	AGUILAR-...	72B HBC	$K^- p \rightarrow \Lambda \pi$ 's
36 ± 4	1260	<sup>9</sup> SIEGEL	67 HBC	$K^- p$ 2.1 GeV/c
32.0 ± 4.7	750	<sup>9</sup> ARMENTEROS <sup>65B</sup>	HBC	$K^- p$ 0.95–1.20 GeV/c
46.5 ± 6.4	859	<sup>9</sup> HUWE	64 HBC	$K^- p$ 1.15–1.30 GeV/c

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

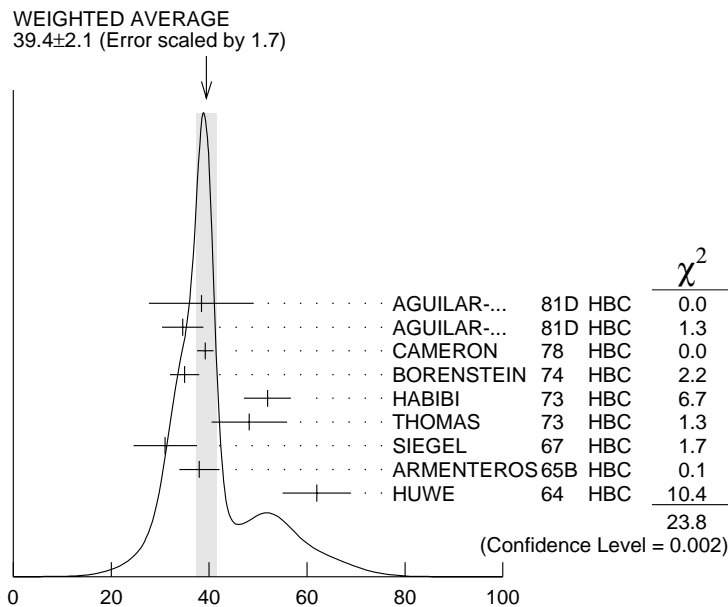
40 ± 3	600	BAKER	80 HYBR	$\pi^+ p$ 7 GeV/c
37 ± 2	750	BAKER	80 HYBR	$K^- p$ 7 GeV/c
37 ± 2	7k	<sup>1</sup> BAUBILLIER	79B HBC	$K^- p$ 8.25 GeV/c
30 ± 4	2k	CAUTIS	79 HYBR	$\pi^+ p / K^- p$ 11.5 GeV
30 ± 6	100	<sup>1</sup> SUGAHARA	79B HBC	$\pi^- p$ 6 GeV/c
43 ± 5	22k	<sup>1,2</sup> BARREIRO	77B HBC	$K^- p$ 4.2 GeV/c
34 ± 2	2594	HOLMGREN	77 HBC	See AGUILAR 81D
40.0 ± 3.2		<sup>1</sup> BARDADIN-...	75 HBC	$K^- p$ 14.3 GeV/c
48 ± 3	3740	<sup>3</sup> BERTHON	74 HBC	$K^- p$ 1263–1843 MeV/c
33 ± 20	46	<sup>9</sup> AGUILAR-...	70B HBC	$K^- p \rightarrow \Sigma \pi$ 's 4 GeV/c
25 ± 32	62	<sup>9</sup> BIRMINGHAM	66 HBC	$K^- p$ 3.5 GeV/c
30.3 ± 7.5	250	<sup>9</sup> SMITH	65 HBC	$K^- p$ 1.8 GeV/c
33.1 ± 8.3	250	<sup>9</sup> SMITH	65 HBC	$K^- p$ 1.95 GeV/c
51 ± 16	170	<sup>9</sup> COOPER	64 HBC	$K^- p$ 1.45 GeV/c
48 ± 16	154	<sup>9</sup> ELY	61 HLBC	$K^- p$ 1.11 GeV/c

**$\Sigma(1385)^0$  WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>36 ± 5 OUR AVERAGE</b>				
34.8 ± 5.6	5722	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda 3\pi$ 4.2 GeV/c
39.3 ± 10.2	240	<sup>9</sup> THOMAS	73 HBC	$\pi^- p \rightarrow \Lambda \pi^0 K^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
53 ± 8	3100	<sup>10</sup> BORENSTEIN	74 HBC	$K^- p \rightarrow \Lambda 3\pi$ 2.18 GeV/c
30 ± 9	106	CURTIS	63 OSPK	$\pi^- p$ 1.5 GeV/c

## $\Sigma(1385)^-$ WIDTH

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>39.4 ± 2.1 OUR AVERAGE</b>	Error	includes scale factor of 1.7.		See the ideogram below.
38.4 ± 10.7	620	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda \pi \pi$ 4.2 GeV/c
34.6 ± 4.2	3346	AGUILAR-...	81D HBC	$K^- p \rightarrow \Lambda 3\pi$ 4.2 GeV/c
39.2 ± 1.7	9720	CAMERON	78 HBC	$K^- p$ 0.96–1.36 GeV/c
35 ± 3	2303	<sup>8</sup> BORENSTEIN	74 HBC	$K^- p$ 2.18 GeV/c
51.9 ± 4.8	1900	<sup>9</sup> HABIBI	73 HBC	$K^- p \rightarrow \Lambda \pi \pi$
48.2 ± 7.7	630	<sup>9</sup> THOMAS	73 HBC	$\pi^- p \rightarrow \Lambda \pi^- K^0$
31.0 ± 6.5	370	<sup>9</sup> SIEGEL	67 HBC	$K^- p$ 2.1 GeV/c
38.0 ± 4.1	1382	<sup>9</sup> ARMENTEROS <sup>65B</sup>	HBC	$K^- p$ 0.95–1.20 GeV/c
62 ± 7	1086	HUWE	64 HBC	$K^- p$ 1.15–1.30 GeV/c
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
44 ± 4	4.5k	<sup>1</sup> BAUBILLIER	79B HBC	$K^- p$ 8.25 GeV/c
58 ± 4	150	<sup>1</sup> SUGAHARA	79B HBC	$\pi^- p$ 6 GeV/c
45 ± 5	12k	<sup>1,2</sup> BARREIRO	77B HBC	$K^- p$ 4.2 GeV/c
35 ± 10	193	HOLMGREN	77 HBC	See AGUILAR 81D
47 ± 6		<sup>1</sup> BARDADIN-...	75 HBC	$K^- p$ 14.3 GeV/c
40 ± 3	3060	<sup>3</sup> BERTHON	74 HBC	$K^- p$ 1263–1843 MeV/c
29.2 ± 10.6	120	<sup>9</sup> SMITH	65 HBC	$K^- p$ 1.80 GeV/c
17.1 ± 8.9	58	<sup>9</sup> SMITH	65 HBC	$K^- p$ 1.95 GeV/c
88 ± 24	200	<sup>9</sup> COOPER	64 HBC	$K^- p$ 1.45 GeV/c
40		DAHL	61 DBC	$K^- d$ 0.45 GeV/c
66 ± 18	224	<sup>9</sup> ELY	61 HLBC	$K^- p$ 1.11 GeV/c



$\Sigma(1385)^-$  width (MeV)

### $\Sigma(1385)$ POLE POSITIONS

#### $\Sigma(1385)^+$ REAL PART

VALUE	DOCUMENT ID	COMMENT
1379±1	LICHTENBERG74	Extrapolates HABIBI 73

#### $\Sigma(1385)^+$ -IMAGINARY PART

VALUE	DOCUMENT ID	COMMENT
17.5±1.5	LICHTENBERG74	Extrapolates HABIBI 73

#### $\Sigma(1385)^-$ REAL PART

VALUE	DOCUMENT ID	COMMENT
1383±1	LICHTENBERG74	Extrapolates HABIBI 73

#### $\Sigma(1385)^-$ -IMAGINARY PART

VALUE	DOCUMENT ID	COMMENT
22.5±1.5	LICHTENBERG74	Extrapolates HABIBI 73

### $\Sigma(1385)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $\Lambda\pi$	88±2 %
$\Gamma_2$ $\Sigma\pi$	12±2 %

$$\begin{aligned} \Gamma_3 & \Lambda\gamma \\ \Gamma_4 & \Sigma\gamma \\ \Gamma_5 & N\bar{K} \end{aligned}$$

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

### $\Sigma(1385)$ BRANCHING RATIOS

$\Gamma(\Sigma\pi)/\Gamma(\Lambda\pi)$	$\Gamma_2/\Gamma_1$				
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
<b>0.135 ± 0.011 OUR AVERAGE</b>					
0.20 ± 0.06	DIONISI	78B	HBC	±	$K^- p \rightarrow Y^* K \bar{K}$
0.16 ± 0.03	BERTHON	74	HBC	+	$K^- p$ 1.26–1.84 GeV/c
0.11 ± 0.02	BERTHON	74	HBC	–	$K^- p$ 1.26–1.84 GeV/c
0.21 ± 0.05	BORENSTEIN	74	HBC	+	$K^- p \rightarrow \Lambda\pi^+\pi^-, \Sigma^0\pi^+\pi^-$
0.18 ± 0.04	MAST	73	MPWA	±	$K^- p \rightarrow \Lambda\pi^+\pi^-, \Sigma^0\pi^+\pi^-$
0.10 ± 0.05	THOMAS	73	HBC	–	$\pi^- p \rightarrow \Lambda K\pi, \Sigma K\pi$
0.16 ± 0.07	AGUILAR-...	72B	HBC	+	$K^- p$ 3.9, 4.6 GeV/c
0.13 ± 0.04	COLLEY	71B	DBC	–0	$K^- N$ 1.5 GeV/c
0.13 ± 0.04	PAN	69	HBC	+	$\pi^+ p \rightarrow \Lambda K\pi, \Sigma K\pi$
0.08 ± 0.06	LONDON	66	HBC	+	$K^- p$ 2.24 GeV/c
0.163 ± 0.041	ARMENTEROS65B		HBC	±	$K^- p$ 0.95–1.20 GeV/c
0.09 ± 0.04	HUWE	64	HBC	±	$K^- p$ 1.2–1.7 GeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.04	ALSTON	62	HBC	±0	$K^- p$ 1.15 GeV/c
0.04 ± 0.04	BASTIEN	61	HBC	±	

$\Gamma(\Lambda\gamma)/\Gamma_{\text{total}}$	$\Gamma_3/\Gamma$				
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.17 ± 0.17	1	MEISNER	72	HBC	1 event only

$\Gamma(\Lambda\gamma)/\Gamma(\Lambda\pi)$	$\Gamma_3/\Gamma_1$				
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.06	90	COLAS	75	HLBC	$K^- p$ 575–970 MeV

$\Gamma(\Sigma\gamma)/\Gamma(\Lambda\pi)$	$\Gamma_4/\Gamma_1$				
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.05	90	COLAS	75	HLBC	$K^- p$ 575–970 MeV



$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1385) \rightarrow \Lambda\pi$	DOCUMENT ID	CHG	COMMENT
VALUE +0.586 ± 0.319	11 DEVENISH	74B 0	Fixed- <i>t</i> dispersion rel.

 **$\Sigma(1385)$  FOOTNOTES**

- <sup>1</sup> From fit to inclusive  $\Lambda\pi$  spectrum.
- <sup>2</sup> Includes data of HOLMGREN 77.
- <sup>3</sup> The errors are statistical only. The resolution is not unfolded.
- <sup>4</sup> The error is enlarged to  $\Gamma/\sqrt{N}$ . See the note on the  $K^*(892)$  mass in the 1984 edition.
- <sup>5</sup> From a fit to  $\Lambda\pi^0$  with the width fixed at 34 MeV.
- <sup>6</sup> From fit to inclusive  $\Lambda\pi^0$  spectrum with the width fixed at 40 MeV.
- <sup>7</sup> Redundant with data in the mass Listings.
- <sup>8</sup> Results from  $\Lambda\pi^+\pi^-$  and  $\Lambda\pi^+\pi^-\pi^0$  combined by us.
- <sup>9</sup> The error is enlarged to  $4\Gamma/\sqrt{N}$ . See the note on the  $K^*(892)$  mass in the 1984 edition.
- <sup>10</sup> Consistent with +, 0, and - widths equal.
- <sup>11</sup> An extrapolation of the parametrized amplitude below threshold.

 **$\Sigma(1385)$  REFERENCES**

BAUBILLIER 84	ZPHY C23 213	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
PDG 84	RMP 56 No. 2 Pt. II	C.G. Wohl <i>et al.</i>	(LBL, CIT, CERN)
AGUILAR-... 81D	AFIS A77 144	M. Aguilar-Benitez, J. Salicio	(MADR)
BAKER 80	NP B166 207	P.A. Baker <i>et al.</i>	(LOIC)
BAUBILLIER 79B	NP B148 18	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
CAUTIS 79	NP B156 507	C.V. Cautis <i>et al.</i>	(SLAC)
SUGAHARA 79B	NP B156 237	R. Sugahara <i>et al.</i>	(KEK, OSKC, KINK)
CAMERON 78	NP B143 189	W. Cameron <i>et al.</i>	(RHEL, LOIC)
DIONISI 78B	PL 78B 154	C. Dionisi, R. Armenteros, J. Diaz	(CERN, AMST+)
BARREIRO 77B	NP B126 319	F. Barreiro <i>et al.</i>	(CERN, AMST, NIJM)
HOLMGREN 77	NP B119 261	S.O. Holmgren <i>et al.</i>	(CERN, AMST, NIJM)
BARDADIN-... 75	NP B98 418	M. Bardadin-Otwinowska <i>et al.</i>	(SACL, EPOL+)
COLAS 75	NP B91 253	J. Colas <i>et al.</i>	(ORSAY)
BERTHON 74	NC 21A 146	A. Berthon <i>et al.</i>	(CDEF, RHEL, SACL+)
BORENSTEIN 74	PR D9 3006	S.R. Borenstein <i>et al.</i>	(BNL, MICH)
DEVENISH 74B	NP B81 330	R.C.E. Devenish, C.D. Froggatt, B.R. Martin	(DESY+)
LICHTENBERG 74	PR D10 3865	D.B. Lichtenberg	(IND)
Also 74B	Private Comm.	D.B. Lichtenberg	(IND)
HABIBI 73	Thesis Nevis 199	M. Habibi	(COLU)
Also 73	Purdue Conf. 387	C. Baltay <i>et al.</i>	(COLU, BING)
MAST 73	PR D7 3212	T.S. Mast <i>et al.</i>	(LBL) IJP
Also 73B	PR D7 5	T.S. Mast <i>et al.</i>	(LBL) IJP
THOMAS 73	NP B56 15	D.W. Thomas <i>et al.</i>	(CMU) JP
AGUILAR-... 72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)
MEISNER 72	NC 12A 62	G.W. Meisner	(UNC, LBL)
COLLEY 71B	NP B31 61	D.C. Colley <i>et al.</i>	(BIRM, EDIN, GLAS+)
AGUILAR-... 70B	PRL 25 58	M. Aguilar-Benitez <i>et al.</i>	(BNL, SYRA)
PAN 69	PRL 23 808	Y.L. Pan, F.L. Forman	(PENN) I
SIEGEL 67	Thesis UCRL 18041	D.M. Siegel	(LRL)
BIRMINGHAM 66	PR 152 1148	M. Haque <i>et al.</i>	(BIRM, GLAS, LOIC, OXF+)
LONDON 66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) J
ARMENTEROS 65B	PL 19 75	R. Armenteros <i>et al.</i>	(CERN, HEID, SACL)
SMITH 65	Thesis UCLA	L.T. Smith	(UCLA)
COOPER 64	PL 8 365	W.A. Cooper <i>et al.</i>	(CERN, AMST)
HUWE 64	Thesis UCRL 11291	D.O. Huwe	(LRL) JP
Also 69	PR 180 1824	D.O. Huwe	(LRL)
CURTIS 63	PR 132 1771	L.J. Curtis <i>et al.</i>	(MICH) J
ALSTON 62	CERN Conf. 311	M.H. Alston <i>et al.</i>	(LRL)
BASTIEN 61	PRL 6 702	P.L. Bastien, M. Ferro-Luzzi, A.H. Rosenfeld	(LRL)
DAHL 61	PRL 6 142	O.I. Dahl <i>et al.</i>	(LRL)
ELY 61	PRL 7 461	R.P. Ely <i>et al.</i>	(LRL) J
ALSTON 60	PRL 5 520	M.H. Alston <i>et al.</i>	(LRL) I