

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

We have omitted some results that have been superseded by later experiments. See our earlier editions.

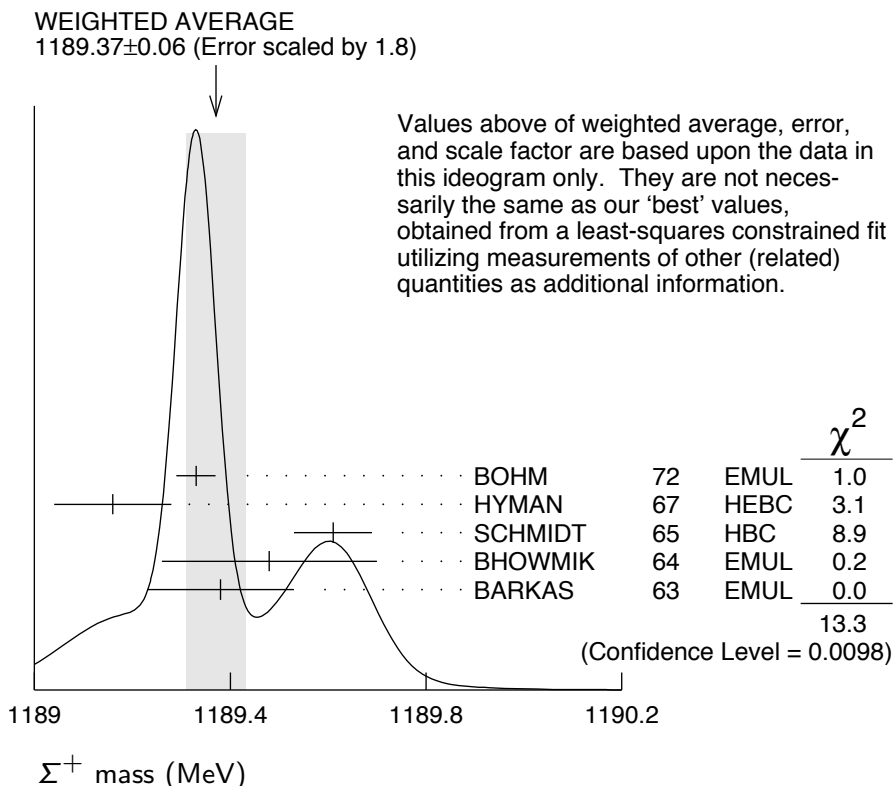
### $\Sigma^+$ MASS

The fit uses  $\Sigma^+$ ,  $\Sigma^0$ ,  $\Sigma^-$ , and  $\Lambda$  mass and mass-difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1189.37±0.07 OUR FIT</b>				Error includes scale factor of 2.2.
<b>1189.37±0.06 OUR AVERAGE</b>				Error includes scale factor of 1.8. See the ideogram below.
1189.33±0.04	607	<sup>1</sup> BOHM	72	EMUL
1189.16±0.12		HYMAN	67	HEBC
1189.61±0.08	4205	SCHMIDT	65	HBC See note with $\Lambda$ mass
1189.48±0.22	58	<sup>2</sup> BHOWMIK	64	EMUL
1189.38±0.15	144	<sup>2</sup> BARKAS	63	EMUL

<sup>1</sup> BOHM 72 is updated with our 1973  $K^-$ ,  $\pi^-$ , and  $\pi^0$  masses (Reviews of Modern Physics **45** S1 (1973)).

<sup>2</sup> These masses have been raised 30 keV to take into account a 46 keV increase in the proton mass and a 21 keV decrease in the  $\pi^0$  mass (note added 1967 edition, Reviews of Modern Physics **39** 1 (1967)).



## $\Sigma^+$ MEAN LIFE

Measurements with fewer than 1000 events have been omitted.

<u>VALUE (<math>10^{-10}</math> s)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.8018 ± 0.0026 OUR AVERAGE</b>				
0.8038 ± 0.0040 ± 0.0014		BARBOSA	00	E761 hyperons, 375 GeV
0.8043 ± 0.0080 ± 0.0014		<sup>3</sup> BARBOSA	00	E761 hyperons, 375 GeV
0.798 ± 0.005	30k	MARRAFFINO	80	HBC $K^- p$ 0.42–0.5 GeV/c
0.807 ± 0.013	5719	CONFORTO	76	HBC $K^- p$ 1–1.4 GeV/c
0.795 ± 0.010	20k	EISELE	70	HBC $K^- p$ at rest
0.803 ± 0.008	10664	BARLOUTAUD	69	HBC $K^- p$ 0.4–1.2 GeV/c
0.83 ± 0.032	1300	<sup>4</sup> CHANG	66	HBC

<sup>3</sup> This is a measurement of the  $\bar{\Sigma}^-$  lifetime. Here we assume *CPT* invariance; see below for the fractional  $\Sigma^+ - \bar{\Sigma}^-$  lifetime difference obtained by BARBOSA 00.

<sup>4</sup> We have increased the CHANG 66 error of 0.018; see our 1970 edition, *Reviews of Modern Physics* **42** 87 (1970).

$$(\tau_{\Sigma^+} - \tau_{\bar{\Sigma}^-}) / \tau_{\Sigma^+}$$

A test of *CPT* invariance.

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>(-6 ± 12) × 10<sup>-4</sup></b>	BARBOSA	00	E761 hyperons, 375 GeV

## $\Sigma^+$ MAGNETIC MOMENT

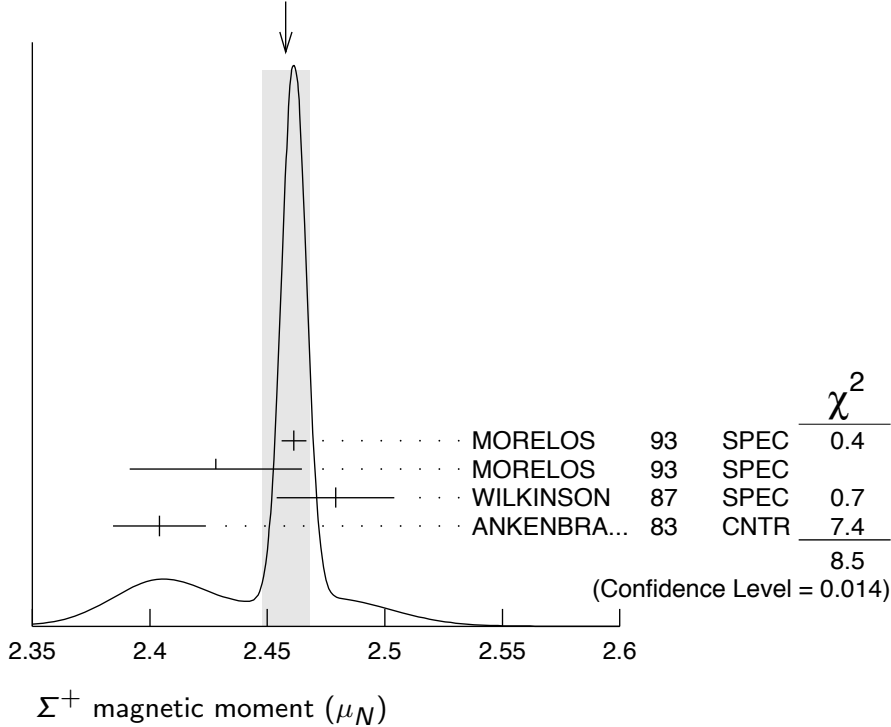
See the “Note on Baryon Magnetic Moments” in the  $\Lambda$  Listings. Measurements with an error  $\geq 0.1 \mu_N$  have been omitted.

<u>VALUE (<math>\mu_N</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2.458 ± 0.010 OUR AVERAGE</b> Error includes scale factor of 2.1. See the ideogram below.				
2.4613 ± 0.0034 ± 0.0040	250k	MORELOS	93	SPEC $p$ Cu 800 GeV
2.428 ± 0.036 ± 0.007	12k	<sup>5</sup> MORELOS	93	SPEC $p$ Cu 800 GeV
2.479 ± 0.012 ± 0.022	137k	WILKINSON	87	SPEC $p$ Be 400 GeV
2.4040 ± 0.0198	44k	<sup>6</sup> ANKENBRA...	83	CNTR $p$ Cu 400 GeV

<sup>5</sup> We assume *CPT* invariance: this is (minus) the  $\bar{\Sigma}^-$  magnetic moment as measured by MORELOS 93. See below for the moment difference testing *CPT*.

<sup>6</sup> ANKENBRANDT 83 gives the value  $2.38 \pm 0.02 \mu_N$ . MORELOS 93 uses the same hyperon magnet and channel and claims to determine the field integral better, leading to the revised value given here.

WEIGHTED AVERAGE  
 $2.458 \pm 0.010$  (Error scaled by 2.1)



$$(\mu_{\Sigma^+} + \mu_{\Sigma^-}) / \mu_{\Sigma^+}$$

A test of *CPT* invariance.

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.014 \pm 0.015</math></b>	<sup>7</sup> MORELOS	93	SPEC $p\text{Cu } 800 \text{ GeV}$

<sup>7</sup>This is our calculation from the MORELOS 93 measurements of the  $\Sigma^+$  and  $\Sigma^-$  magnetic moments given above. The statistical error on  $\mu_{\Sigma^-}$  dominates the error here.

### $\Sigma^+$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level
$\Gamma_1$ $p\pi^0$	$(51.57 \pm 0.30) \%$	
$\Gamma_2$ $n\pi^+$	$(48.31 \pm 0.30) \%$	
$\Gamma_3$ $p\gamma$	$(1.23 \pm 0.05) \times 10^{-3}$	
$\Gamma_4$ $n\pi^+\gamma$	[a] $(4.5 \pm 0.5) \times 10^{-4}$	
$\Gamma_5$ $\Lambda e^+ \nu_e$	$(2.0 \pm 0.5) \times 10^{-5}$	

### $\Delta S = \Delta Q$ (SQ) violating modes or $\Delta S = 1$ weak neutral current (S1) modes

$\Gamma_6$ $ne^+ \nu_e$	SQ	$< 5 \times 10^{-6}$	90%
$\Gamma_7$ $n\mu^+ \nu_\mu$	SQ	$< 3.0 \times 10^{-5}$	90%
$\Gamma_8$ $pe^+ e^-$	S1	$< 7 \times 10^{-6}$	
$\Gamma_9$ $p\mu^+ \mu^-$	S1	$(9 \pm_{-8}^9) \times 10^{-8}$	

[a] See the Listings below for the pion momentum range used in this measurement.

### CONSTRAINED FIT INFORMATION

An overall fit to 2 branching ratios uses 14 measurements and one constraint to determine 3 parameters. The overall fit has a  $\chi^2 = 7.7$  for 12 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients  $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$ , in percent, from the fit to the branching fractions,  $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$ . The fit constrains the  $x_i$  whose labels appear in this array to sum to one.

$x_2$	-100	
$x_3$	12	-14
	$x_1$	$x_2$

### $\Sigma^+$ BRANCHING RATIOS

$\Gamma(n\pi^+) / \Gamma(N\pi)$   $\Gamma_2 / (\Gamma_1 + \Gamma_2)$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.4836 ± 0.0030 OUR FIT</b>				
<b>0.4836 ± 0.0030 OUR AVERAGE</b>				
0.4828 ± 0.0036	10k	<sup>8</sup> MARRAFFINO 80	HBC	$K^- p$ 0.42–0.5 GeV/c
0.488 ± 0.008	1861	NOWAK 78	HBC	
0.484 ± 0.015	537	TOVEE 71	EMUL	
0.488 ± 0.010	1331	BARLOUTAUD 69	HBC	$K^- p$ 0.4–1.2 GeV/c
0.46 ± 0.02	534	CHANG 66	HBC	
0.490 ± 0.024	308	HUMPHREY 62	HBC	

<sup>8</sup> MARRAFFINO 80 actually gives  $\Gamma(p\pi^0) / \Gamma(\text{total}) = 0.5172 \pm 0.0036$ .

$\Gamma(p\gamma) / \Gamma(p\pi^0)$   $\Gamma_3 / \Gamma_1$

<u>VALUE (units <math>10^{-3}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2.38 ± 0.10 OUR FIT</b>				
<b>2.38 ± 0.10 OUR AVERAGE</b>				
2.32 ± 0.11 ± 0.10	32k	TIMM 95	E761	$\Sigma^+$ 375 GeV
2.81 ± 0.39 <sup>+0.21</sup> / <sub>-0.43</sub>	408	HESSEY 89	CNTR	$K^- p \rightarrow \Sigma^+ \pi^-$ at rest
2.52 ± 0.28	190	<sup>9</sup> KOBAYASHI 87	CNTR	$\pi^+ p \rightarrow \Sigma^+ K^+$
2.46 <sup>+0.30</sup> / <sub>-0.35</sub>	155	BIAGI 85	CNTR	CERN hyperon beam
2.11 ± 0.38	46	MANZ 80	HBC	$K^- p \rightarrow \Sigma^+ \pi^-$
2.1 ± 0.3	45	ANG 69B	HBC	$K^- p$ at rest
2.76 ± 0.51	31	GERSHWIN 69B	HBC	$K^- p \rightarrow \Sigma^+ \pi^-$
3.7 ± 0.8	24	BAZIN 65	HBC	$K^- p$ at rest

<sup>9</sup> KOBAYASHI 87 actually gives  $\Gamma(p\gamma) / \Gamma(\text{total}) = (1.30 \pm 0.15) \times 10^{-3}$ .

### $\Gamma(n\pi^+\gamma)/\Gamma(n\pi^+)$

$\Gamma_4/\Gamma_2$

The  $\pi^+$  momentum cuts differ, so we do not average the results but simply use the latest value in the Summary Table.

<u>VALUE (units <math>10^{-3}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.93±0.10</b>	180	EBENHOH	73	HBC $\pi^+ < 150$ MeV/c
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.27±0.05	29	ANG	69B	HBC $\pi^+ < 110$ MeV/c
~ 1.8		BAZIN	65B	HBC $\pi^+ < 116$ MeV/c

### $\Gamma(\Lambda e^+\nu_e)/\Gamma_{\text{total}}$

$\Gamma_5/\Gamma$

<u>VALUE (units <math>10^{-5}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2.0±0.5 OUR AVERAGE</b>				
1.6±0.7	5	BALTAY	69	HBC $K^- p$ at rest
2.9±1.0	10	EISELE	69	HBC $K^- p$ at rest
2.0±0.8	6	BARASH	67	HBC $K^- p$ at rest

### $\Gamma(ne^+\nu_e)/\Gamma(n\pi^+)$

$\Gamma_6/\Gamma_2$

Test of  $\Delta S = \Delta Q$  rule. Experiments with an effective denominator less than 100,000 have been omitted.

<u>EFFECTIVE DENOM.</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>&lt; 1.1 × 10<sup>-5</sup> OUR LIMIT</b> Our 90% CL limit = (2.3 events)/(effective denominator sum). [Number of events increased to 2.3 for a 90% confidence level.]				
111000	0	<sup>10</sup> EBENHOH	74	HBC $K^- p$ at rest
105000	0	<sup>10</sup> SECHI-ZORN	73	HBC $K^- p$ at rest

<sup>10</sup> Effective denominator calculated by us.

### $\Gamma(n\mu^+\nu_\mu)/\Gamma(n\pi^+)$

$\Gamma_7/\Gamma_2$

Test of  $\Delta S = \Delta Q$  rule.

<u>EFFECTIVE DENOM.</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>&lt; 6.2 × 10<sup>-5</sup> OUR LIMIT</b> Our 90% CL limit = (6.7 events)/(effective denominator sum). [Number of events increased to 6.7 for a 90% confidence level.]				
33800	0	BAGGETT	69B	HBC
62000	2	<sup>11</sup> EISELE	69B	HBC
10150	0	<sup>12</sup> COURANT	64	HBC
1710	0	<sup>12</sup> NAUENBERG	64	HBC
120	1	GALTIERI	62	EMUL

<sup>11</sup> Effective denominator calculated by us.

<sup>12</sup> Effective denominator taken from EISELE 67.

### $\Gamma(pe^+e^-)/\Gamma_{\text{total}}$

$\Gamma_8/\Gamma$

<u>VALUE (units <math>10^{-6}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>&lt;7</b>	<sup>13</sup> ANG	69B	HBC $K^- p$ at rest

<sup>13</sup> ANG 69B found three  $pe^+e^-$  events in agreement with  $\gamma \rightarrow e^+e^-$  conversion from  $\Sigma^+ \rightarrow p\gamma$ . The limit given here is for neutral currents.

$\Gamma(p\mu^+\mu^-)/\Gamma_{\text{total}}$   $\Gamma_9/\Gamma$

A test for a  $\Delta S = 1$  weak neutral current, but also allowed by higher-order electroweak interactions.

VALUE (units $10^{-8}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
$8.6^{+6.6}_{-5.4} \pm 5.5$	3	<sup>14</sup> PARK	05	HYCP $p$ Cu, 800 GeV

<sup>14</sup>The masses of the three dimuons of PARK 05 are within 1 MeV of one another, perhaps indicating the existence of a new state  $P^0$  with mass  $214.3 \pm 0.5$  MeV. In that case, the decay is  $\Sigma^+ \rightarrow pP^0$ ,  $P^0 \rightarrow \mu^+\mu^-$ , with a branching fraction of  $(3.1^{+2.4}_{-1.9} \pm 1.5) \times 10^{-8}$ .

$\Gamma(\Sigma^+ \rightarrow ne^+\nu_e)/\Gamma(\Sigma^- \rightarrow ne^-\bar{\nu}_e)$   $\Gamma_6/\Gamma_3^{\Sigma^-}$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
-------	-----	------	-------------	------	---------

**<0.009 OUR LIMIT** Our 90% CL limit, using  $\Gamma(ne^+\nu_e)/\Gamma(n\pi^+)$  above.

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

<0.019	90	0	EBENHOH	74	HBC	$K^- p$ at rest
<0.018	90	0	SECHI-ZORN	73	HBC	$K^- p$ at rest
<0.12	95	0	COLE	71	HBC	$K^- p$ at rest
<0.03	90	0	EISELE	69B	HBC	See EBENHOH 74

$\Gamma(\Sigma^+ \rightarrow n\mu^+\nu_\mu)/\Gamma(\Sigma^- \rightarrow n\mu^-\bar{\nu}_\mu)$   $\Gamma_7/\Gamma_4^{\Sigma^-}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

**<0.12 OUR LIMIT** Our 90% CL limit, using  $\Gamma(n\mu^+\nu_\mu)/\Gamma(n\pi^+)$  above.

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

$0.06^{+0.045}_{-0.03}$	2	EISELE	69B	HBC	$K^- p$ at rest
-------------------------	---	--------	-----	-----	-----------------

$\Gamma(\Sigma^+ \rightarrow n\ell^+\nu)/\Gamma(\Sigma^- \rightarrow n\ell^-\bar{\nu})$   $(\Gamma_6+\Gamma_7)/(\Gamma_3^{\Sigma^-}+\Gamma_4^{\Sigma^-})$

Test of  $\Delta S = \Delta Q$  rule.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

**<0.043 OUR LIMIT** Our 90% CL limit, using  $[\Gamma(ne^+\nu_e) + \Gamma(n\mu^+\nu_\mu)]/\Gamma(n\pi^+)$ .

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

<0.08	1	NORTON	69	HBC
<0.034	0	BAGGETT	67	HBC

### $\Sigma^+$ DECAY PARAMETERS

See the "Note on Baryon Decay Parameters" in the neutron Listings. A few early results have been omitted.

$\alpha_0$  FOR  $\Sigma^+ \rightarrow p\pi^0$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

**$-0.980^{+0.017}_{-0.015}$  OUR FIT**

**$-0.980^{+0.017}_{-0.013}$  OUR AVERAGE**

$-0.945^{+0.055}_{-0.042}$	1259	<sup>15</sup> LIPMAN	73	OSPK $\pi^+ p \rightarrow \Sigma^+$
$-0.940 \pm 0.045$	16k	BELLAMY	72	ASPK $\pi^+ p \rightarrow \Sigma^+ K^+$

$-0.98^{+0.05}_{-0.02}$	1335	<sup>16</sup> HARRIS	70	OSPK	$\pi^+ p \rightarrow \Sigma^+ K^+$
$-0.999 \pm 0.022$	32k	BANGERTER	69	HBC	$K^- p$ 0.4 GeV/c

<sup>15</sup> Decay protons scattered off aluminum.

<sup>16</sup> Decay protons scattered off carbon.

**$\phi_0$  ANGLE FOR  $\Sigma^+ \rightarrow p\pi^0$**  **( $\tan \phi_0 = \beta/\gamma$ )**

VALUE (°)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>36 ± 34 OUR AVERAGE</b>				
$38.1^{+35.7}_{-37.1}$	1259	<sup>17</sup> LIPMAN	73	OSPK $\pi^+ p \rightarrow \Sigma^+ K^+$
22 ± 90		<sup>18</sup> HARRIS	70	OSPK $\pi^+ p \rightarrow \Sigma^+ K^+$

<sup>17</sup> Decay proton scattered off aluminum.

<sup>18</sup> Decay protons scattered off carbon.

**$\alpha_+ / \alpha_0$**

Older results have been omitted.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>-0.069 ± 0.013 OUR FIT</b>				
<b>-0.073 ± 0.021</b>	23k	MARRAFFINO 80	HBC	$K^- p$ 0.42–0.5 GeV/c

**$\alpha_+$  FOR  $\Sigma^+ \rightarrow n\pi^+$**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.068 ± 0.013 OUR FIT</b>				
<b>0.066 ± 0.016 OUR AVERAGE</b>				
0.037 ± 0.049	4101	BERLEY 70B	HBC	
0.069 ± 0.017	35k	BANGERTER 69	HBC	$K^- p$ 0.4 GeV/c

**$\phi_+$  ANGLE FOR  $\Sigma^+ \rightarrow n\pi^+$**  **( $\tan \phi_+ = \beta/\gamma$ )**

VALUE (°)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>167 ± 20 OUR AVERAGE</b> Error includes scale factor of 1.1.				
184 ± 24	1054	<sup>19</sup> BERLEY 70B	HBC	
143 ± 29	560	BANGERTER 69B	HBC	$K^- p$ 0.4 GeV/c

<sup>19</sup> Changed from 176 to 184° to agree with our sign convention.

**$\alpha_\gamma$  FOR  $\Sigma^+ \rightarrow p\gamma$**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>-0.76 ± 0.08 OUR AVERAGE</b>				
$-0.720 \pm 0.086 \pm 0.045$	35k	<sup>20</sup> FOUCHER 92	SPEC	$\Sigma^+$ 375 GeV
$-0.86 \pm 0.13 \pm 0.04$	190	KOBAYASHI 87	CNTR	$\pi^+ p \rightarrow \Sigma^+ K^+$
$-0.53^{+0.38}_{-0.36}$	46	MANZ 80	HBC	$K^- p \rightarrow \Sigma^+ \pi^-$
$-1.03^{+0.52}_{-0.42}$	61	GERSHWIN 69B	HBC	$K^- p \rightarrow \Sigma^+ \pi^-$

<sup>20</sup> See TIMM 95 for a detailed description of the analysis.

$\Sigma^+$  REFERENCES

We have omitted some papers that have been superseded by later experiments. See our earlier editions.

PARK	05	PRL 94 021801	H.K. Park <i>et al.</i>	(FNAL HyperCP Collab.)
BARBOSA	00	PR D61 031101R	R.F. Barbosa <i>et al.</i>	(FNAL E761 Collab.)
TIMM	95	PR D51 4638	S. Timm <i>et al.</i>	(FNAL E761 Collab.)
MORELOS	93	PRL 71 3417	A. Morelos <i>et al.</i>	(FNAL E761 Collab.)
FOUCHER	92	PRL 68 3004	M. Foucher <i>et al.</i>	(FNAL E761 Collab.)
HESSEY	89	ZPHY C42 175	N.P. Hessey <i>et al.</i>	(BNL-811 Collab.)
KOBAYASHI	87	PRL 59 868	M. Kobayashi <i>et al.</i>	(KYOT)
WILKINSON	87	PRL 58 855	C.A. Wilkinson <i>et al.</i>	(WISC, MICH, RUTG+)
BIAGI	85	ZPHY C28 495	S.F. Biagi <i>et al.</i>	(CERN WA62 Collab.)
ANKENBRA... MANZ	83 80	PRL 51 863 PL 96B 217	C.M. Ankenbrandt <i>et al.</i> A. Manz <i>et al.</i>	(FNAL, IOWA, ISU+) (MPIM, VAND)
MARRAFFINO	80	PR D21 2501	J. Marraffino <i>et al.</i>	(VAND, MPIM)
NOWAK	78	NP B139 61	R.J. Nowak <i>et al.</i>	(LOUC, BELG, DURH+)
CONFORTO	76	NP B105 189	B. Conforto <i>et al.</i>	(RHEL, LOIC)
EBENHOH	74	ZPHY 266 367	H. Ebenhoh <i>et al.</i>	(HEIDT)
EBENHOH	73	ZPHY 264 413	W. Ebenhoh <i>et al.</i>	(HEIDT)
LIPMAN	73	PL 43B 89	N.H. Lipman <i>et al.</i>	(RHEL, SUSS, LOWC)
PDG	73	RMP 45 S1	T.A. Lasinski <i>et al.</i>	(LBL, BRAN, CERN+)
SECHI-ZORN	73	PR D8 12	B. Sechi-Zorn, G.A. Snow	(UMD)
BELLAMY	72	PL 39B 299	E.H. Bellamy <i>et al.</i>	(LOWC, RHEL, SUSS)
BOHM	72	NP B48 1	G. Bohm <i>et al.</i>	(BERL, KIDR, BRUX, IASD+)
Also		IIHE-73.2 Nov	G. Bohm	(BERL, KIDR, BRUX, IASD, DUUC+)
COLE	71	PR D4 631	J. Cole <i>et al.</i>	(STON, COLU)
TOVEE	71	NP B33 493	D.N. Tovee <i>et al.</i>	(LOUC, KIDR, BERL+)
BERLEY	70B	PR D1 2015	D. Berley <i>et al.</i>	(BNL, MASA, YALE)
EISELE	70	ZPHY 238 372	F. Eisele <i>et al.</i>	(HEID)
HARRIS	70	PRL 24 165	F. Harris <i>et al.</i>	(MICH, WISC)
PDG	70	RMP 42 87	A. Barbaro-Galtieri <i>et al.</i>	(LRL, BRAN+)
ANG	69B	ZPHY 228 151	G. Ang <i>et al.</i>	(HEID)
BAGGETT	69B	Thesis MDDP-TR-973	N.V. Baggett	(UMD)
BALTAY	69	PRL 22 615	C. Baltay <i>et al.</i>	(COLU, STON)
BANGERTER	69	Thesis UCRL 19244	R.O. Bangerter	(LRL)
BANGERTER	69B	PR 187 1821	R.O. Bangerter <i>et al.</i>	(LRL)
BARLOUTAUD	69	NP B14 153	R. Barloutaud <i>et al.</i>	(SACL, CERN, HEID)
EISELE	69	ZPHY 221 1	F. Eisele <i>et al.</i>	(HEID)
Also		PRL 13 291	W. Willis <i>et al.</i>	(BNL, CERN, HEID, UMD)
EISELE	69B	ZPHY 221 401	F. Eisele <i>et al.</i>	(HEID)
GERSHWIN	69B	PR 188 2077	L.K. Gershwin <i>et al.</i>	(LRL)
Also		Thesis UCRL 19246	L.K. Gershwin	(LRL)
NORTON	69	Thesis Nevis 175	H. Norton	(COLU)
BAGGETT	67	PRL 19 1458	N. Baggett <i>et al.</i>	(UMD)
Also		Vienna Abs. 374	N.V. Baggett, B. Kehoe	(UMD)
Also		Private Comm.	N.V. Baggett	(UMD)
BARASH	67	PRL 19 181	N. Barash <i>et al.</i>	(UMD)
EISELE	67	ZPHY 205 409	F. Eisele <i>et al.</i>	(HEID)
HYMAN	67	PL 25B 376	L.G. Hyman <i>et al.</i>	(ANL, CMU, NWES)
PDG	67	RMP 39 1	A.H. Rosenfeld <i>et al.</i>	(LRL, CERN, YALE)
CHANG	66	PR 151 1081	C.Y. Chang	(COLU)
Also		Thesis Nevis 145	C.Y. Chang	(COLU)
BAZIN	65	PRL 14 154	M. Bazin <i>et al.</i>	(PRIN, COLU)
BAZIN	65B	PR 140B 1358	M. Bazin <i>et al.</i>	(PRIN, RUTG, COLU)
SCHMIDT	65	PR 140B 1328	P. Schmidt	(COLU)
BHOWMIK	64	NP 53 22	B. Bhowmik <i>et al.</i>	(DELH)
COURANT	64	PR 136 B1791	H. Courant <i>et al.</i>	(CERN, HEID, UMD+)
NAUENBERG	64	PRL 12 679	U. Nauenberg <i>et al.</i>	(COLU, RUTG, PRIN)
BARKAS	63	PRL 11 26	W.H. Barkas, J.N. Dyer, H.H. Heckman	(LRL)
Also		Thesis UCRL 9450	J.N. Dyer	(LRL)
GALTIERI	62	PRL 9 26	A. Barbaro-Galtieri <i>et al.</i>	(LRL)
HUMPHREY	62	PR 127 1305	W.E. Humphrey, R.R. Ross	(LRL)