Baryon Full Listings

Σ^+

Σ^+ DECAY MODES

	Mode		Fraction (Γ_i/Γ)	Confidence level
Γ_1	$p\pi^0$		(51.57 ± 0.30) %	
Γ_2	$n\pi^+$		(48.30 ± 0.30) %	
Γ_3	$p\gamma$		(1.25 ± 0.07) × 10^{-3}	
Γ_4	$n\pi^+\gamma$	[a]	(4.5 ± 0.5) × 10^{-4}	
Γ_5	$\Lambda e^+\nu_e$		(2.0 ± 0.5) × 10^{-5}	

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

Γ_6	$ne^+\nu_e$	SQ	<	5	× 10^{-6}	90%
Γ_7	$n\mu^+\nu_\mu$	SQ	<	3.0	× 10^{-5}	90%
Γ_8	pe^+e^-	$S1$	<	7	× 10^{-6}	

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

CONSTRAINED FIT INFORMATION

An overall fit to 2 branching ratios uses 13 measurements and one constraint to determine 3 parameters. The overall fit has a χ^2 = 7.5 for 11 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	9	−11
	x_1	x_2

Σ^+ BRANCHING RATIOS

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.4836 ± 0.0030 OUR FIT					
0.4836 ± 0.0030 OUR AVERAGE					
0.4828 ± 0.0036	10k	[7] 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	

[7] MARRAFFINO 80 actually gives $\Gamma(p\pi^0)/\Gamma(\text{total}) = 0.5172 \pm 0.0036$.

$\Gamma(p\gamma)/\Gamma(p\pi^0)$ — **Γ_3/Γ_1**

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.43 ± 0.14 OUR FIT					
2.43 ± 0.14 OUR AVERAGE					
$2.81 \pm 0.39^{+0.21}_{-0.43}$	408	HESSEY	89	CNTR	$K^-p \to \Sigma^+\pi^-$ at rest
2.52 ± 0.28	190	[8] KOBAYASHI	87	CNTR	$\pi^+p \to \Sigma^+K^+$
$2.46^{+0.30}_{-0.35}$	155	BIAGI	85	CNTR	CERN hyperon beam
2.11 ± 0.38	46	MANZ	80	HBC	$K^-p \to \Sigma^+\pi^-$
2.1 ± 0.3	45	ANG	69B	HBC	K^-p at rest
2.76 ± 0.51	31	GERSHWIN	69B	HBC	$K-p \to \Sigma^+\pi^-$
3.7 ± 0.8	24	BAZIN	65	HBC	K^-p at rest

[8] KOBAYASHI 87 actually gives $\Gamma(p\gamma)/\Gamma(\text{total}) = (1.30 \pm 0.15) \times 10^{-3}$.

$\Gamma(n\pi^+\gamma)/\Gamma(n\pi^+)$ — **Γ_4/Γ_2**

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

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

$\Gamma(\Lambda e^+\nu_e)/\Gamma_{\text{total}}$ — **Γ_5/Γ**

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
2.0 ± 0.5 OUR AVERAGE					
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

$\Gamma(ne^+\nu_e)/\Gamma(n\pi^+)$ — **Γ_6/Γ_2**

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

EFFECTIVE DENOM.	EVTS	DOCUMENT ID		TECN	COMMENT
< 1.1 × 10^{-5} OUR LIMIT		Our 90% CL limit = (2.3 events)/(effective denominator sum). [Number of events increased to 2.3 for a 90% confidence level.]			
111000	0	[9] EBENHOH	74	HBC	K^-p at rest
105000	0	[9] SECHI-ZORN	73	HBC	K^-p at rest

[9] Effective denominator calculated by us.

$\Gamma(n\mu^+\nu_\mu)/\Gamma(n\pi^+)$ — **Γ_7/Γ_2**

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

EFFECTIVE DENOM.	EVTS	DOCUMENT ID		TECN	
< 6.2 × 10^{-5} OUR LIMIT		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	[10] EISELE	69B	HBC	
10150	0	[11] COURANT	64	HBC	
1710	0	[11] NAUENBERG	64	HBC	
120	1	GALTIERI	62	EMUL	

[10] Effective denominator calculated by us.
[11] Effective denominator taken from EISELE 67.

$\Gamma(pe^+e^-)/\Gamma_{\text{total}}$ — **Γ_8/Γ**

VALUE (units 10^{-6})	DOCUMENT ID		TECN	COMMENT
< 7	[12] ANG	69B	HBC	K^-p at rest

[12] ANG 69B found three pe^+e^- events in agreement with $\gamma \to e^+e^-$ conversion from $\Sigma^+ \to p\gamma$. The limit given here is for neutral currents.

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

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

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

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

$\Gamma(\Sigma^+ \to n\ell^+\nu)/\Gamma(\Sigma^- \to n\ell^-\bar{\nu})$

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

VALUE	EVTS	DOCUMENT ID		TECN
< 0.043 OUR LIMIT		Our 90% CL limit, using $\left[\Gamma(ne^+\nu_e) + \Gamma(n\mu^+\nu_\mu)\right]/\Gamma(n\pi^+)$.		
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.08	1	NORTON	69	HBC
< 0.034	0	BAGGETT	67	HBC

Σ^+ DECAY PARAMETERS

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

α_0 FOR $\Sigma^+ \to p\pi^0$

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	[13] LIPMAN	73	OSPK	$\pi^+p \to \Sigma^+$
−0.940 ± 0.045	16k	BELLAMY	72	ASPK	$\pi^+p \to \Sigma^+K^+$
$-0.98^{+0.05}_{-0.02}$	1335	[14] HARRIS	70	OSPK	$\pi^+p \to \Sigma^+K^+$
−0.999 ± 0.022	32k	BANGERTER	69	HBC	K^-p 0.4 GeV/c

[13] Decay protons scattered off aluminum.
[14] Decay protons scattered off carbon.

ϕ_0 ANGLE FOR $\Sigma^+ \to p\pi^0$ — **($\tan\phi_0 = \beta/\gamma$)**

VALUE (°)	EVTS	DOCUMENT ID		TECN	COMMENT
36 ± 34 OUR AVERAGE					
$38.1^{+35.7}_{-37.1}$	1259	[15] LIPMAN	73	OSPK	$\pi^+p \to \Sigma^+K^+$
22 ± 90		[16] HARRIS	70	OSPK	$\pi^+p \to \Sigma^+K^+$

[15] Decay proton scattered off aluminum.
[16] Decay protons scattered off carbon.