Σ BARYONS
$(S = -1, I = 1)$
$$\Sigma^+ = uus, \quad \Sigma^0 = uds, \quad \Sigma^- = dds$$

Σ^+

$$I(J^P) = 1(\tfrac{1}{2}^+)$$

Mass $m = 1189.37 \pm 0.07$ MeV   (S = 2.2)

Mean life $\tau = (0.8018 \pm 0.0026) \times 10^{-10}$ s

$\quad c\tau = 2.404$ cm

$(\tau_{\Sigma^+} - \tau_{\overline{\Sigma}^-}) / \tau_{\Sigma^+} = -0.0006 \pm 0.0012$

Magnetic moment $\mu = 2.458 \pm 0.010 \, \mu_N$ (S = 2.1)

$(\mu_{\Sigma^+} + \mu_{\overline{\Sigma}^-}) / \mu_{\Sigma^+} = 0.014 \pm 0.015$

$\Gamma(\Sigma^+ \to n\ell^+\nu)/\Gamma(\Sigma^- \to n\ell^-\overline{\nu}_\ell) < 0.043$

Decay parameters

$p\pi^0$	$\alpha_0 = -0.982 \pm 0.014$
$\overline{p}\pi^0$	$\overline{\alpha}_0 = 0.99 \pm 0.04$
$(\alpha_0 + \overline{\alpha}_0) / (\alpha_0 - \overline{\alpha}_0) = 0.00 \pm 0.04$	
$p\pi^0$	$\phi_0 = (36 \pm 34)°$
"	$\gamma_0 = 0.16$ [a]
"	$\Delta_0 = (187 \pm 6)°$ [a]
$n\pi^+$	$\alpha_+ = (4.89 \pm 0.26) \times 10^{-2}$
"	$\phi_+ = (167 \pm 20)°$ (S = 1.1)
$\overline{\alpha}_-$ FOR $\overline{\Sigma}^- \to \overline{n}\pi^- = (-5.7 \pm 0.5) \times 10^{-2}$	
$\overline{\alpha}_- / \overline{\alpha}_0 = (-5.7 \pm 0.6) \times 10^{-2}$	
$(\alpha_+ + \overline{\alpha}_-) / (\alpha_+ - \overline{\alpha}_-) = (-8 \pm 6) \times 10^{-2}$	
"	$\gamma_+ = -0.97$ [a]
"	$\Delta_+ = (-73^{+133}_{-10})°$ [a]
$p\gamma$	$\alpha_\gamma = -0.69 \pm 0.05$

Σ^+ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$p\pi^0$	(51.47 ± 0.30) %		189
$n\pi^+$	(48.43 ± 0.30) %		185
$p\gamma$	$(1.04 \pm 0.06) \times 10^{-3}$	S=2.4	225
$n\pi^+\gamma$	[b] $(4.5 \pm 0.5) \times 10^{-4}$		185
$\Lambda e^+\nu_e$	$(2.3 \pm 0.4) \times 10^{-5}$		71

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

$ne^+\nu_e$	SQ	$< 5 \times 10^{-6}$	CL=90%	224

$n\mu^+\nu_\mu$	SQ	< 3.0	$\times 10^{-5}$	CL=90%	202
pe^+e^-	S1	< 7	$\times 10^{-6}$		225
$p\mu^+\mu^-$	S1	$(2.4\,^{+1.7}_{-1.3})\times 10^{-8}$			121

$\boxed{\Sigma^0}$ $\qquad\qquad I(J^P) = 1(\tfrac{1}{2}^+)$

Mass $m = 1192.642 \pm 0.024$ MeV
$m_{\Sigma^-} - m_{\Sigma^0} = 4.807 \pm 0.035$ MeV   (S = 1.1)
$m_{\Sigma^0} - m_\Lambda = 76.959 \pm 0.023$ MeV
Mean life $\tau = (7.4 \pm 0.7) \times 10^{-20}$ s
$\quad c\tau = 2.22 \times 10^{-11}$ m
Transition magnetic moment $|\mu_{\Sigma\Lambda}| = 1.61 \pm 0.08\ \mu_N$

Σ^0 DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda\gamma$	100 %		74
$\Lambda\gamma\gamma$	< 3 %	90%	74
$\Lambda e^+ e^-$	[c] 5×10^{-3}		74

$\boxed{\Sigma^-}$ $\qquad\qquad I(J^P) = 1(\tfrac{1}{2}^+)$

Mass $m = 1197.449 \pm 0.029$ MeV   (S = 1.1)
$m_{\Sigma^-} - m_{\Sigma^+} = 8.08 \pm 0.08$ MeV   (S = 1.9)
$m_{\Sigma^-} - m_\Lambda = 81.766 \pm 0.029$ MeV   (S = 1.1)
Mean life $\tau = (1.479 \pm 0.011) \times 10^{-10}$ s   (S = 1.3)
$\quad c\tau = 4.434$ cm
Magnetic moment $\mu = -1.160 \pm 0.025\ \mu_N$ (S = 1.7)
Σ^- charge radius $= 0.78 \pm 0.10$ fm

Decay parameters

$n\pi^-$	$\alpha_- = -0.068 \pm 0.008$
"	$\phi_- = (10 \pm 15)°$
"	$\gamma_- = 0.98$ [a]
"	$\Delta_- = (249\,^{+\ 12}_{-120})°$ [a]
$ne^-\overline{\nu}_e$	$g_A/g_V = 0.340 \pm 0.017$ [d]
"	$f_2(0)/f_1(0) = 0.97 \pm 0.14$
"	$D = 0.11 \pm 0.10$
$\Lambda e^-\overline{\nu}_e$	$g_V/g_A = 0.01 \pm 0.10$ [d] (S = 1.5)
"	$g_{WM}/g_A = 2.4 \pm 1.7$ [d]

Σ^- DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$n\pi^-$		(99.848 ± 0.005) %		193
$n\pi^-\gamma$	[b]	$(4.6 \pm 0.6) \times 10^{-4}$		193
$n e^- \overline{\nu}_e$		$(1.017 \pm 0.034) \times 10^{-3}$		230
$n\mu^- \overline{\nu}_\mu$		$(4.5 \pm 0.4) \times 10^{-4}$		210
$\Lambda e^- \overline{\nu}_e$		$(5.73 \pm 0.27) \times 10^{-5}$		79
$\Sigma^+ X$		$< 1.2 \times 10^{-4}$	90%	–

Lepton number (L) violating modes

		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$p e^- e^-$	L	$< 6.7 \times 10^{-5}$	90%	231

$\Sigma(1385)\ 3/2^+$ $\qquad I(J^P) = 1(\tfrac{3}{2}^+)$

$\Sigma(1385)^+$ mass $m = 1382.83 \pm 0.34$ MeV   ($S = 1.9$)
$\Sigma(1385)^0$ mass $m = 1383.7 \pm 1.0$ MeV   ($S = 1.4$)
$\Sigma(1385)^-$ mass $m = 1387.2 \pm 0.5$ MeV   ($S = 2.2$)
$\Sigma(1385)^+$ full width $\Gamma = 36.2 \pm 0.7$ MeV
$\Sigma(1385)^0$ full width $\Gamma = 36 \pm 5$ MeV
$\Sigma(1385)^-$ full width $\Gamma = 39.4 \pm 2.1$ MeV   ($S = 1.7$)
Below $\overline{K}N$ threshold

$\Sigma(1385)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda\pi$	(87.0 ± 1.5) %		208
$\Sigma\pi$	(11.7 ± 1.5) %		129
$\Lambda\gamma$	$(1.25^{+0.13}_{-0.12})$ %		241
$\Sigma^+\gamma$	$(7.0 \pm 1.7) \times 10^{-3}$		180
$\Sigma^-\gamma$	$< 2.4 \times 10^{-4}$	90%	173

$\Sigma(1660)\ 1/2^+$ $\qquad I(J^P) = 1(\tfrac{1}{2}^+)$

Re(pole position) $= 1585 \pm 20$ MeV
-2Im(pole position) $= 290^{+140}_{-40}$ MeV
Mass $m = 1640$ to 1680 (≈ 1660) MeV
Full width $\Gamma = 100$ to 300 (≈ 200) MeV

$\Sigma(1660)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\overline{K}$	0.05 to 0.15 (≈ 010)	405
$\Lambda\pi$	(35 ± 12) %	440
$\Sigma\pi$	(37 ± 10) %	387

$\Sigma\,\sigma$	$(20 \quad \pm\; 8 \quad)\,\%$	–
$\Lambda(1405)\pi$	$(\; 4.0 \;\pm\; 2.0)\,\%$	199

$\boxed{\boldsymbol{\Sigma(1670)\; 3/2^-}}$ $\quad\quad\quad I(J^P) = 1(\tfrac{3}{2}^-)$

Mass $m = 1665$ to 1685 (≈ 1675) MeV
Full width $\Gamma = 40$ to 100 (≈ 70) MeV

$\Sigma(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\overline{K}$	0.06 to 0.12	419
$\Lambda\pi$	5–15 %	452
$\Sigma\pi$	30–60 %	398
$\quad\Sigma\,\sigma$	$(7.0 \;\pm 3.0)\,\%$	–

$\boxed{\boldsymbol{\Sigma(1750)\; 1/2^-}}$ $\quad\quad\quad I(J^P) = 1(\tfrac{1}{2}^-)$

Mass $m = 1700$ to 1800 (≈ 1750) MeV
Full width $\Gamma = 100$ to 200 (≈ 150) MeV

$\Sigma(1750)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\overline{K}$	0.06 to 0.12	486
$\Lambda\pi$	$(14 \quad \pm 5 \quad)\,\%$	507
$\Sigma\pi$	$(16 \quad \pm 4 \quad)\,\%$	456
$\Sigma\eta$	15–55 %	98
$\Sigma(1385)\pi$, D-wave	$< 1 \quad\quad\quad\%$	305
$\Lambda(1520)\pi$	$(\; 2.0 \;\pm 1.0)\,\%$	175
$N\overline{K}^*(892)$, $S=1/2$	$(\; 8 \quad \pm 4 \quad)\,\%$	†

$\boxed{\boldsymbol{\Sigma(1775)\; 5/2^-}}$ $\quad\quad\quad I(J^P) = 1(\tfrac{5}{2}^-)$

Mass $m = 1770$ to 1780 (≈ 1775) MeV
Full width $\Gamma = 105$ to 135 (≈ 120) MeV

$\Sigma(1775)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\overline{K}$	37–43%	508
$\Lambda\pi$	14–20%	525
$\Sigma\pi$	2–5%	475
$\Sigma(1385)\pi$	8–12%	327
$\Lambda(1520)\pi$, P-wave	17–23%	202

Σ(1910) 3/2⁻

$$I(J^P) = 1(\tfrac{3}{2}^-)$$

was Σ(1940)

Mass m = 1870 to 1950 ($\approx$ 1910) MeV
Full width Γ = 150 to 300 ($\approx$ 220) MeV

Σ(1910) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\overline{K}$	0.01 to 0.05 ($\approx$ 0.02)	615
$\Lambda\pi$	(6 $\pm$ 4) %	619
$\Sigma\pi$	(86 $\pm$21) %	574
$\Sigma(1385)\pi$	seen	439
$\Lambda(1520)\pi$	seen	329
$\Delta(1232)\overline{K}$	(3.0 $\pm$ 1.0) %	377
$N\overline{K}^*(892)$	seen	274
$N\overline{K}^*(892)$, S=1/2 , D-wave	(1.0 $\pm$ 1.0) %	274

Σ(1915) 5/2⁺

$$I(J^P) = 1(\tfrac{5}{2}^+)$$

Mass m = 1900 to 1935 ($\approx$ 1915) MeV
Full width Γ = 80 to 160 ($\approx$ 120) MeV

Σ(1915) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\overline{K}$	0.05 to 0.15	618
$\Lambda\pi$	(6.0 $\pm$2.0) %	623
$\Sigma\pi$	(10.0 $\pm$2.0) %	577
$\Sigma(1385)\pi$, P-wave	(2.0 $\pm$2.0) %	443
$\Sigma(1385)\pi$, F-wave	(4.0 $\pm$2.0) %	443
$\Lambda(1520)\pi$, D-wave	(8.0 $\pm$2.0) %	334
$N\overline{K}^*(892)$, S=1/2, F-wave	(5.0 $\pm$3.0) %	282
$N\overline{K}^*(892)$, S=3/2, F-wave	(5.0 $\pm$2.0) %	282
$\Delta\overline{K}$, P-wave	(16 $\pm$5) %	383
$\Delta\overline{K}$, F-wave	(5.0 $\pm$3.0) %	383

$\Sigma(2030)\ 7/2^+$ $\qquad\qquad I(J^P) = 1(\frac{7}{2}^+)$

Mass $m = 2025$ to 2040 (≈ 2030) MeV
Full width $\Gamma = 150$ to 200 (≈ 180) MeV

$\Sigma(2030)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\overline{K}$	17–23 %	702
$\Lambda\pi$	17–23 %	700
$\Sigma\pi$	5–10 %	657
ΞK	<2 %	422
$\Sigma(1385)\pi$	5–15 %	532
$\quad\Sigma(1385)\pi$, F-wave	(1.0±1.0) %	532
$\Lambda(1520)\pi$	10–20 %	431
$\Delta(1232)\overline{K}$	10–20 %	498
$\quad\Delta(1232)\overline{K}$, F-wave	(15 ±5) %	498
$\quad\Delta(1232)\overline{K}$, H-wave	(1.0±1.0) %	498
$\quad N\overline{K}^*(892)$, $S=3/2$, F-wave	(14 ±8) %	439

NOTES

[a] The decay parameters γ and Δ are calculated from α and ϕ using

$$\gamma = \sqrt{1-\alpha^2}\ \cos\phi, \qquad\qquad \tan\Delta = -\frac{1}{\alpha}\ \sqrt{1-\alpha^2}\ \sin\phi.$$

See the "Note on Baryon Decay Parameters" in the neutron Particle Listings.

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

[c] A theoretical value using QED.

[d] The parameters g_A, g_V, and g_{WM} for semileptonic modes are defined by $\overline{B}_f[\gamma_\lambda(g_V + g_A\gamma_5) + i(g_{WM}/m_{B_i})\ \sigma_{\lambda\nu}\ q^\nu]B_i$, and ϕ_{AV} is defined by $g_A/g_V = |g_A/g_V|e^{i\phi_{AV}}$. See the "Note on Baryon Decay Parameters" in the neutron Particle Listings.