NODE=S019

Σ^+

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

We have omitted some results that have been superseded by later experiments.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

NODE=S019

Σ^+ MASS

NODE=S019M

The fit uses Σ^+, Σ^0, Σ^-, and Λ mass and mass-difference measurements.

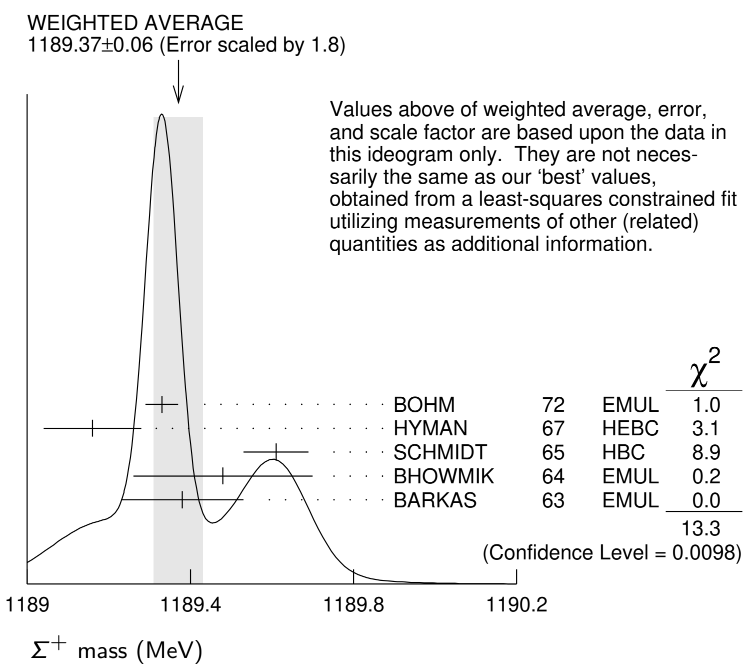
NODE=S019M

NODE=S019M

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

[1] BOHM 72 is updated with our 1973 K^-, π^-, and π^0 masses (Reviews of Modern Physics **45** S1 (1973)). NODE=S019M;LINKAGE=B

[2] 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 π^0 mass (note added 1967 edition, Reviews of Modern Physics **39** 1 (1967)). NODE=S019M;LINKAGE=S



Σ^+ MEAN LIFE

NODE=S019T

Measurements with fewer than 1000 events have been omitted.

NODE=S019T

NODE=S019T

VALUE (10^{-10} s)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.8018±0.0026 OUR AVERAGE					
0.8038±0.0040±0.0014		BARBOSA	00	E761	hyperons, 375 GeV
0.8043±0.0080±0.0014		[1] 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	[2] CHANG	66	HBC	

OCCUR=2

[1] This is a measurement of the $\overline{\Sigma}^-$ lifetime. Here we assume *CPT* invariance; see below for the fractional Σ^+-$\overline{\Sigma}^-$ lifetime difference obtained by BARBOSA 00. NODE=S019T;LINKAGE=T2

[2] We have increased the CHANG 66 error of 0.018; see our 1970 edition, Reviews of Modern Physics **42** 87 (1970). NODE=S019T;LINKAGE=C

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

NODE=S019DT

A test of *CPT* invariance. NODE=S019DT

NODE=S019DT

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{(-6\pm12)\times10^{-4}}$	BARBOSA	00	E761	hyperons, 375 GeV

Σ^+ MAGNETIC MOMENT

NODE=S019MM

See the "Quark Model" review. Measurements with an error $\geq$ 0.1 μ_N have been omitted. NODE=S019MM

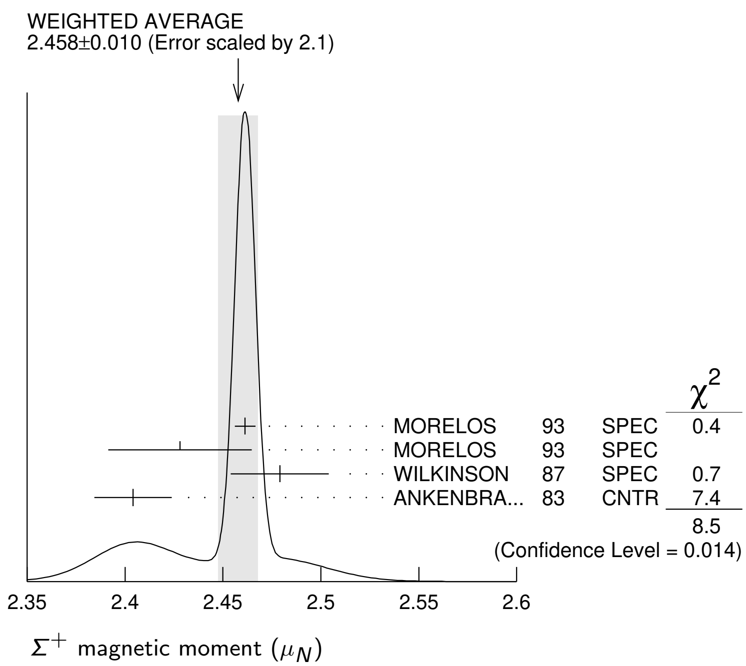
NODE=S019MM

VALUE (μ_N)	EVTS	DOCUMENT ID		TECN	COMMENT
2.458 ±0.010 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.					
2.4613±0.0034±0.0040	250k	MORELOS	93	SPEC	pCu 800 GeV
2.428 ±0.036 ±0.007	12k	[1] MORELOS	93	SPEC	pCu 800 GeV
2.479 ±0.012 ±0.022	137k	WILKINSON	87	SPEC	pBe 400 GeV
2.4040±0.0198	44k	[2] ANKENBRA...	83	CNTR	pCu 400 GeV

OCCUR=2

[1] We assume *CPT* invariance: this is (minus) the $\overline{\Sigma}^-$ magnetic moment as measured by MORELOS 93. See below for the moment difference testing *CPT*. NODE=S019MM;LINKAGE=A

[2] ANKENBRANDT 83 gives the value 2.38 ± 0.02μ_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. NODE=S019MM;LINKAGE=B



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

NODE=S019MMD

A test of *CPT* invariance. NODE=S019MMD

NODE=S019MMD

VALUE	DOCUMENT ID		TECN	COMMENT
0.014±0.015	[1] MORELOS	93	SPEC	pCu 800 GeV

[1] This is our calculation from the MORELOS 93 measurements of the Σ^+ and $\overline{\Sigma}^-$ magnetic moments given above. The statistical error on $\mu_{\overline{\Sigma}^-}$ dominates the error here. NODE=S019MMD;LINKAGE=A

Σ^+ DECAY MODES

NODE=S019220;NODE=S019

	Mode			Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1	$p\pi^0$			(51.47 ± 0.30) %		DESIG=1
Γ_2	$n\pi^+$			(48.43 ± 0.30) %		DESIG=2
Γ_3	$p\gamma$			$(1.04\pm0.06)\times10^{-3}$	S=2.4	DESIG=5
Γ_4	$n\pi^+\gamma$		[a]	$(4.5\pm0.5)\times10^{-4}$		DESIG=3
Γ_5	$\Lambda e^+\nu_e$			$(2.3\pm0.4)\times10^{-5}$		DESIG=4
	$\Delta S = \Delta Q$ (SQ) violating modes or $\Delta S = 1$ weak neutral current ($S1$) modes					NODE=S019;CLUMP=A
Γ_6	$ne^+\nu_e$	*SQ*		$<5\times10^{-6}$	CL=90%	DESIG=7;OUR LIM;→ UNCHECKED ←
Γ_7	$n\mu^+\nu_\mu$	*SQ*		$<3.0\times10^{-5}$	CL=90%	DESIG=6;OUR LIM;→ UNCHECKED ←
Γ_8	pe^+e^-	*S1*		$<7\times10^{-6}$		DESIG=8
Γ_9	$p\mu^+\mu^-$	*S1*		$(1.09\pm0.17)\times10^{-8}$		DESIG=9
Γ_{10}	$p\gamma_{dark}$			$<3.2\times10^{-5}$	CL=90%	DESIG=195

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

LINKAGE=SD

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 15 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 =$ 22.0 for 13 degrees of freedom.

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

x_2	−100	
x_3	5	−7
	x_1	x_2

Σ^+ BRANCHING RATIOS

NODE=S019225

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

NODE=S019R1
NODE=S019R1

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.4848±0.0030 OUR FIT					
0.4836±0.0030 OUR AVERAGE					
0.4828±0.0036	10k	[1] 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	

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

NODE=S019R1;LINKAGE=M

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

NODE=S019R4
NODE=S019R4

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2.03±0.11 OUR FIT Error includes scale factor of 2.4.					
2.38±0.10 OUR AVERAGE					
$2.32\pm0.11\pm0.10$	32k	TIMM	95	E761	Σ^+ 375 GeV
$2.81\pm0.39^{+0.21}_{-0.43}$	408	HESSEY	89	CNTR	$K^-p\to\Sigma^+\pi^-$ at rest
2.52 ± 0.28	190	[1] 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

[1] KOBAYASHI 87 actually gives $\Gamma(p\gamma)/\Gamma(\text{total}) = (1.30 \pm 0.15)\times10^{-3}$.

NODE=S019R4;LINKAGE=M

$\Gamma(p\gamma)/\Gamma_{total}$ — Γ_3/Γ

NODE=S019R00
NODE=S019R00

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.04 ±0.06 OUR FIT Error includes scale factor of 2.4.					
0.996±0.021±0.018	2.5k	[1] ABLIKIM	23Y	BES3	$e^+e^- \to J/\psi \to \Sigma\overline{\Sigma}$

[1] This value is quoted by ABLIKIM 23Y for the simultaneous fit to $\Sigma \to p\gamma$ and $\overline{\Sigma} \to \overline{p}\gamma$ assuming no CP violation. Individual values for the branching fractions are given as $(1.005 \pm 0.032) \times 10^{-3}$ and $(0.993 \pm 0.030) \times 10^{-3}$, respectively.

NODE=S019R00;LINKAGE=A

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

NODE=S019R2
NODE=S019R2

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

NODE=S019R2

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
0.93±0.10	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

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

NODE=S019R3
NODE=S019R3

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
2.3 ±0.4 OUR AVERAGE					
2.93±0.74±0.13	16	ABLIKIM	23AA	BES3	$e^+e^- \to J/\psi \to \Sigma\overline{\Sigma}$
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

NODE=S019R5
NODE=S019R5

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

NODE=S019R5

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	[1] EBENHOH	74	HBC	K^-p at rest
105000	0	[1] SECHI-ZORN	73	HBC	K^-p at rest

→ UNCHECKED ←

[1] Effective denominator calculated by us.

NODE=S019R5;LINKAGE=U

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

NODE=S019R6

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

NODE=S019R6
NODE=S019R6

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	[1] EISELE	69B	HBC
10150	0	[2] COURANT	64	HBC
1710	0	[2] NAUENBERG	64	HBC
120	1	GALTIERI	62	EMUL

→ UNCHECKED ←

[1] Effective denominator calculated by us.
[2] Effective denominator taken from EISELE 67.

NODE=S019R6;LINKAGE=U
NODE=S019R6;LINKAGE=E

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

NODE=S019R8
NODE=S019R8

VALUE (units 10^{-6})	DOCUMENT ID		TECN	COMMENT
<7	[1] ANG	69B	HBC	K^-p at rest

[1] 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.

NODE=S019R8;LINKAGE=A1

$\Gamma(p\mu^+\mu^-)/\Gamma_{total}$ — Γ_9/Γ

NODE=S019R12
NODE=S019R12

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

NODE=S019R12

VALUE (units 10^{-8})	EVTS	DOCUMENT ID		TECN	COMMENT
1.09±0.17 OUR AVERAGE [$(2.4^{+1.7}_{-1.3}) \times 10^{-8}$ OUR 2025 AVERAGE]					
1.09±0.17	0.25k	[1] AAIJ	25D	LHCB	pp at 7, 8, 13 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.08±0.17	237	[2] AAIJ	25D	LHCB	pp at 13 TeV
2.2 $^{+0.9}_{-0.8}$ $^{+1.5}_{-1.1}$	10.2	[3] AAIJ	18E	LHCB	pp at 7, 8 TeV
8.6 $^{+6.6}_{-5.4}$ ±5.5	3	[4] PARK	05	HYCP	p Cu, 800 GeV

NEW
OCCUR=2

[1] Combination of AAIJ 18E (Run 1) and AAIJ 25D (Run 2) results. NODE=S019R12;LINKAGE=C
[2] Uses B($\Sigma^+ \to p\pi^0$) = $(51.57 \pm 0.30) \times 10^{-2}$. NODE=S019R12;LINKAGE=B
[3] AAIJ 18E sees no structure in the dimuon mass distribution, contrary to PARK 05. NODE=S019R12;LINKAGE=A
[4] 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 ± 0.5 MeV. In that case, the decay is $\Sigma^+ \to pP^0$, $P^0 \to \mu^+\mu^-$, with a branching fraction of $(3.1^{+2.4}_{-1.9} \pm 1.5) \times 10^{-8}$. NODE=S019R12;LINKAGE=PA

$\Gamma(p\gamma_{dark})/\Gamma_{total}$ Γ_{10}/Γ

NODE=S019R03
NODE=S019R03

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.2 × 10^{-5}	90	[1] ABLIKIM	24AF	BES3	J/ψ, $\psi(2S) \to \Sigma^+\overline{\Sigma}^-$

[1] FCNC search for invisible massless particles (dark photons) using missing energy in Σ hyperon decays to a proton. For a QCD axion scenario, a competitive lower limit can be derived for the axial-vector part of the s-d flavor-violating axion-fermion effective decay constant $F^A_{sd} > 2.8 \times 10^7$ GeV. NODE=S019R03;LINKAGE=A

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

NODE=S019R10
NODE=S019R10

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

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

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<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

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

NODE=S019R9
NODE=S019R9

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

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.06^{+0.045}_{-0.03}$	2	EISELE	69B	HBC	K^-p at rest

$\Gamma(\Sigma^+ \to n\ell^+\nu)/\Gamma(\Sigma^- \to n\ell^-\overline{\nu}_\ell)$ $(\Gamma_6+\Gamma_7)/(\Gamma_3^{\Sigma^-}+\Gamma_4^{\Sigma^-})$

NODE=S019R7

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

NODE=S019R7
NODE=S019R7

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

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

VALUE	EVTS	DOCUMENT ID		TECN
<0.08	1	NORTON	69	HBC
<0.034	0	BAGGETT	67	HBC

Σ^+ DECAY PARAMETERS

NODE=S019230

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

NODE=S019230

α_0 FOR $\Sigma^+ \to p\pi^0$

NODE=S019A0
NODE=S019A0

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.977±0.009 OUR FIT					
[−0.982 ± 0.014 OUR 2025 FIT]					
−0.977±0.009 OUR AVERAGE					
[$-0.982^{+0.016}_{-0.013}$ OUR 2025 AVERAGE]					
−0.975±0.011±0.002	1.07M	[1] ABLIKIM	25BT	BES3	$J/\psi/\psi(2S) \to \Sigma^+\overline{\Sigma}^-$
$-0.945^{+0.055}_{-0.042}$	1259	[2] 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	[3] HARRIS	70	OSPK	$\pi^+p \to \Sigma^+K^+$
−0.999±0.022	32k	BANGERTER	69	HBC	K^-p 0.4 GeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−0.998±0.037±0.009	93k	[4] ABLIKIM	20X	BES3	$J/\psi/\psi(2S) \to \Sigma^+\overline{\Sigma}^-$

NEW
NEW

[1] ABLIKIM 25BT uses production through $e^+e \to J/\psi \to \Sigma^+\overline{\Sigma}^-$ and $e^+e \to \psi(2S) \to \Sigma^+\overline{\Sigma}^-$, with 1016678 ± 1398 and 53293 ± 299 events, respectively. NODE=S019A0;LINKAGE=B
[2] Decay protons scattered off aluminum. NODE=S019A0;LINKAGE=L
[3] Decay protons scattered off carbon. NODE=S019A0;LINKAGE=H
[4] ABLIKIM 20X uses production through $e^+e \to J/\psi \to \Sigma^+\overline{\Sigma}^-$ and $e^+e \to \psi(2S) \to \Sigma^+\overline{\Sigma}^-$, with 87,815 and 5,327 events, respectively. Note that the reported values of decay parameters α_0 of Σ^+ and $\overline{\alpha}_0$ of $\overline{\Sigma}^-$ are correlated. NODE=S019A0;LINKAGE=A

$\overline{\alpha}_0$ FOR $\overline{\Sigma}^- \to \overline{p}\pi^0$ NODE=S019A1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.999±0.012 OUR AVERAGE [0.99 ± 0.04 OUR 2025 AVERAGE]					
0.999±0.011±0.004	1.07M	[1] ABLIKIM	25BT	BES3	$J/\psi / \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.990±0.037±0.011	93k	[2] ABLIKIM	20X	BES3	$J/\psi / \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$

NODE=S019A1 NEW

[1] ABLIKIM 25BT uses production through $e^+ e \to J/\psi \to \Sigma^+ \overline{\Sigma}^-$ and $e^+ e \to \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$, with 1016678 ± 1398 and 53293 ± 299 events, respectively. NODE=S019A1;LINKAGE=B

[2] ABLIKIM 20X uses production through $e^+ e \to J/\psi \to \Sigma^+ \overline{\Sigma}^-$ and $e^+ e \to \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$, with 87,815 and 5,327 events, respectively. Note that the reported values of decay parameters α_0 of Σ^+ and $\overline{\alpha}_0$ of $\overline{\Sigma}^-$ are correlated. NODE=S019A1;LINKAGE=A

$(\alpha_0 + \overline{\alpha}_0) / (\alpha_0 - \overline{\alpha}_0)$ NODE=S019A00

Test of CP violation. NODE=S019A00

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
−1.2 ±0.9 OUR AVERAGE [0.00 ± 0.04 OUR 2025 AVERAGE]					
−1.18±0.83±0.28	1.07M	[1] ABLIKIM	25BT	BES3	$J/\psi / \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.4 ±3.7 ±1.0	93k	[2] ABLIKIM	20X	BES3	$J/\psi / \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$

NODE=S019A00 NEW

[1] ABLIKIM 25BT uses production through $e^+ e \to J/\psi \to \Sigma^+ \overline{\Sigma}^-$ and $e^+ e \to \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$, with 1016678 ± 1398 and 53293 ± 299 events, respectively. NODE=S019A00;LINKAGE=B

[2] ABLIKIM 20X uses production through $e^+ e \to J/\psi \to \Sigma^+ \overline{\Sigma}^-$ and $e^+ e \to \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$, with 87,815 and 5,327 events, respectively. Note that the reported values of decay parameters α_0 of Σ^+ and $\overline{\alpha}_0$ of $\overline{\Sigma}^-$ are correlated. NODE=S019A00;LINKAGE=A

$(\alpha_0 - \overline{\alpha}_0)/2$ NODE=S019A04

Average decay parameter assuming CP conservation. NODE=S019A04

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.9869±0.0011±0.0016	1.07M	[1] ABLIKIM	25BT	BES3	$J/\psi / \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$

NODE=S019A04

[1] ABLIKIM 25BT uses production through $e^+ e \to J/\psi \to \Sigma^+ \overline{\Sigma}^-$ and $e^+ e \to \psi(2S) \to \Sigma^+ \overline{\Sigma}^-$, with 1016678 ± 1398 and 53293 ± 299 events, respectively. NODE=S019A04;LINKAGE=B

ϕ_0 ANGLE FOR $\Sigma^+ \to p\pi^0$ ($\tan\phi_0 = \beta/\gamma$) NODE=S019F0

VALUE (°)	EVTS	DOCUMENT ID		TECN	COMMENT
36 ±34 OUR AVERAGE					
$38.1^{+35.7}_{-37.1}$	1259	[1] LIPMAN	73	OSPK	$\pi^+ p \to \Sigma^+ K^+$
22 ±90		[2] HARRIS	70	OSPK	$\pi^+ p \to \Sigma^+ K^+$

NODE=S019F0

[1] Decay proton scattered off aluminum. NODE=S019F0;LINKAGE=L

[2] Decay protons scattered off carbon. NODE=S019F0;LINKAGE=H

α_+ / α_0 NODE=S019A+0

Older results have been omitted. NODE=S019A+0

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
−4.99±0.27 OUR FIT					
[(−4.98 ± 0.27) × 10^{-2} OUR 2025 FIT]					
−5.0 ±0.4 OUR AVERAGE					
−4.90±0.32±0.21	754k	[1] ABLIKIM	23BN	BES3	$J/\psi \to \Sigma^+ \overline{\Sigma}^-$
−7.3 ±2.1	23k	MARRAFFINO	80	HBC	$K^- p$ 0.42–0.5 GeV/c

NODE=S019A+0 NEW

[1] ABLIKIM 23BN uses production through $e^+ e \to J/\psi \to \Sigma^+ \overline{\Sigma}^-$ with 10G J/ψ events. NODE=S019A+0;LINKAGE=A

α_+ FOR $\Sigma^+ \to n\pi^+$ NODE=S019A+

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
4.88±0.26 OUR FIT					
[(4.89 ± 0.26) × 10^{-2} OUR 2025 FIT]					
4.9 ±0.4 OUR AVERAGE Error includes scale factor of 1.2.					
4.81±0.31±0.19	754k	[1] ABLIKIM	23BN	BES3	$J/\psi \to \Sigma^+ \overline{\Sigma}^-$
3.7 ±4.9	4101	BERLEY	70B	HBC	
6.9 ±1.7	35k	BANGERTER	69	HBC	$K^- p$ 0.4 GeV/c

NODE=S019A+ NEW

[1] ABLIKIM 23BN uses production through $e^+ e \to J/\psi \to \Sigma^+ \overline{\Sigma}^-$ with 10G J/ψ events. NODE=S019A+;LINKAGE=A

ϕ_+ ANGLE FOR $\Sigma^+ \to n\pi^+$ ($\tan\phi_+ = \beta/\gamma$) NODE=S019F+

VALUE (°)	EVTS	DOCUMENT ID		TECN	COMMENT
167±20 OUR AVERAGE Error includes scale factor of 1.1.					
184±24	1054	[1] BERLEY	70B	HBC	
143±29	560	BANGERTER	69B	HBC	$K^- p$ 0.4 GeV/c

NODE=S019F+

[1] Changed from 176 to 184° to agree with our sign convention. NODE=S019F+;LINKAGE=C

$\overline{\alpha}_-$ FOR $\overline{\Sigma}^- \rightarrow \overline{n}\pi^-$

NODE=S019A01
NODE=S019A01

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
−5.65±0.47±0.22	1.1M	[1] ABLIKIM	23BN	BES3	$J/\psi \rightarrow \Sigma^+ \overline{\Sigma}^-$

[1] ABLIKIM 23BN uses production through $e^+ e \rightarrow J/\psi \rightarrow \Sigma^+ \overline{\Sigma}^-$ with 10G J/ψ events.

NODE=S019A01;LINKAGE=A

$\overline{\alpha}_- / \overline{\alpha}_0$

NODE=S019A02
NODE=S019A02

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
−5.71±0.53±0.32	ABLIKIM	23BN	BES3	$J/\psi \rightarrow \Sigma^+ \overline{\Sigma}^-$

$(\alpha_+ + \overline{\alpha}_-) / (\alpha_+ - \overline{\alpha}_-)$

NODE=S019A03
NODE=S019A03

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
−8.0±5.2±2.8	ABLIKIM	23BN	BES3	$J/\psi \rightarrow \Sigma^+ \overline{\Sigma}^-$

α_γ FOR $\Sigma^+ \rightarrow p\gamma$

NODE=S019AG
NODE=S019AG

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.69 ±0.05 OUR AVERAGE					
−0.652±0.056±0.020	2.5k	[1] ABLIKIM	23Y	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \Sigma \overline{\Sigma}$
−0.720±0.086±0.045	35k	[2] FOUCHER	92	SPEC	Σ^+ 375 GeV
−0.86 ±0.13 ±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	$K^- p \rightarrow \Sigma^+ \pi^-$

[1] This value is quoted by ABLIKIM 23Y for the simultaneous fit to $\Sigma \rightarrow p\gamma$ and $\overline{\Sigma} \rightarrow \overline{p}\gamma$ assuming no CP violation. Individual values are given as -0.587 ± 0.082 and 0.710 ± 0.076, respectively.

NODE=S019AG;LINKAGE=B

[2] See TIMM 95 for a detailed description of the analysis.

NODE=S019AG;LINKAGE=A

Σ^+ REFERENCES

NODE=S019

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

NODE=S019

AAIJ	25D	PRL 135 051801	R. Aaij *et al.*	(LHCb Collab.)	REFID=63248
ABLIKIM	25BT	PRL 135 141804	M. Ablikim *et al.*	(BESIII Collab.)	REFID=63613
ABLIKIM	24AF	PL B852 138614	M. Ablikim *et al.*	(BESIII Collab.)	REFID=62685
ABLIKIM	23AA	PR D107 072010	M. Ablikim *et al.*	(BESIII Collab.)	REFID=62084
ABLIKIM	23BN	PRL 131 191802	M. Ablikim *et al.*	(BESIII Collab.)	REFID=62464
ABLIKIM	23Y	PRL 130 211901	M. Ablikim *et al.*	(BESIII Collab.)	REFID=62076
ABLIKIM	20X	PRL 125 052004	M. Ablikim *et al.*	(BESIII Collab.)	REFID=60574
AAIJ	18E	PRL 120 221803	R. Aaij *et al.*	(LHCb Collab.)	REFID=58835
PARK	05	PRL 94 021801	H.K. Park *et al.*	(FNAL HyperCP Collab.)	REFID=50480
BARBOSA	00	PR D61 031101	R.F. Barbosa *et al.*	(FNAL E761 Collab.)	REFID=47344
TIMM	95	PR D51 4638	S. Timm *et al.*	(FNAL E761 Collab.)	REFID=44221
MORELOS	93	PRL 71 3417	A. Morelos *et al.*	(FNAL E761 Collab.)	REFID=43575
FOUCHER	92	PRL 68 3004	M. Foucher *et al.*	(FNAL E761 Collab.)	REFID=41995
HESSEY	89	ZPHY C42 175	N.P. Hessey *et al.*	(BNL-811 Collab.)	REFID=40776
KOBAYASHI	87	PRL 59 868	M. Kobayashi *et al.*	(KYOT)	REFID=40133
WILKINSON	87	PRL 58 855	C.A. Wilkinson *et al.*	(WISC, MICH, RUTG+)	REFID=11909
BIAGI	85	ZPHY C28 495	S.F. Biagi *et al.*	(CERN WA62 Collab.)	REFID=11908
ANKENBRA...	83	PRL 51 863	C.M. Ankenbrandt *et al.*	(FNAL, IOWA, ISU+)	REFID=11907
MANZ	80	PL 96B 217	A. Manz *et al.*	(MPIM, VAND)	REFID=11905
MARRAFFINO	80	PR D21 2501	J. Marraffino *et al.*	(VAND, MPIM)	REFID=11906
NOWAK	78	NP B139 61	R.J. Nowak *et al.*	(LOUC, BELG, DURH+)	REFID=11903
CONFORTO	76	NP B105 189	B. Conforto *et al.*	(RHEL, LOIC)	REFID=11900
EBENHOH	74	ZPHY 266 367	H. Ebenhoh *et al.*	(HEIDT)	REFID=11899
EBENHOH	73	ZPHY 264 413	W. Ebenhoh *et al.*	(HEIDT)	REFID=11895
LIPMAN	73	PL 43B 89	N.H. Lipman *et al.*	(RHEL, SUSS, LOWC)	REFID=11896
PDG	73	RMP 45 S1	T.A. Lasinski *et al.*	(LBL, BRAN, CERN+)	REFID=41172
SECHI-ZORN	73	PR D8 12	B. Sechi-Zorn, G.A. Snow	(UMD)	REFID=11898
BELLAMY	72	PL 39B 299	E.H. Bellamy *et al.*	(LOWC, RHEL, SUSS)	REFID=11892
BOHM	72	NP B48 1	G. Bohm *et al.*	(BERL, KIDR, BRUX, IASD+)	REFID=11893
Also		IIHE-73.2 Nov	G. Bohm	(BERL, KIDR, BRUX, IASD, DUUC+)	REFID=11894
COLE	71	PR D4 631	J. Cole *et al.*	(STON, COLU)	REFID=11890
TOVEE	71	NP B33 493	D.N. Tovee *et al.*	(LOUC, KIDR, BERL+)	REFID=11891
BERLEY	70B	PR D1 2015	D. Berley *et al.*	(BNL, MASA, YALE)	REFID=11885
EISELE	70	ZPHY 238 372	F. Eisele *et al.*	(HEID)	REFID=11886
HARRIS	70	PRL 24 165	F. Harris *et al.*	(MICH, WISC)	REFID=11887
PDG	70	RMP 42 87	A. Barbaro-Galtieri *et al.*	(LRL, BRAN+)	REFID=41173
ANG	69B	ZPHY 228 151	G. Ang *et al.*	(HEID)	REFID=11952
BAGGETT	69B	Thesis MDDP-TR-973	N.V. Baggett	(UMD)	REFID=11875
BALTAY	69	PRL 22 615	C. Baltay *et al.*	(COLU, STON)	REFID=11876
BANGERTER	69	Thesis UCRL 19244	R.O. Bangerter	(LRL)	REFID=11877
BANGERTER	69B	PR 187 1821	R.O. Bangerter *et al.*	(LRL)	REFID=11878
BARLOUTAUD	69	NP B14 153	R. Barloutaud *et al.*	(SACL, CERN, HEID)	REFID=11879
EISELE	69	ZPHY 221 1	F. Eisele *et al.*	(HEID)	REFID=11880
Also		PRL 13 291	W. Willis *et al.*	(BNL, CERN, HEID, UMD)	REFID=11849
EISELE	69B	ZPHY 221 401	F. Eisele *et al.*	(HEID)	REFID=11881

GERSHWIN	69B	PR 188 2077	L.K. Gershwin *et al.*	(LRL)	REFID=11882
Also		Thesis UCRL 19246	L.K. Gershwin	(LRL)	REFID=11883
NORTON	69	Thesis Nevis 175	H. Norton	(COLU)	REFID=11967
BAGGETT	67	PRL 19 1458	N. Baggett *et al.*	(UMD)	REFID=11862
Also		Vienna Abs. 374	N.V. Baggett, B. Kehoe	(UMD)	REFID=11863
Also		Private Comm.	N.V. Baggett	(UMD)	REFID=11864
BARASH	67	PRL 19 181	N. Barash *et al.*	(UMD)	REFID=11865
EISELE	67	ZPHY 205 409	F. Eisele *et al.*	(HEID)	REFID=11866
HYMAN	67	PL 25B 376	L.G. Hyman *et al.*	(ANL, CMU, NWES)	REFID=10122
PDG	67	RMP 39 1	A.H. Rosenfeld *et al.*	(LRL, CERN, YALE)	REFID=41171
CHANG	66	PR 151 1081	C.Y. Chang	(COLU)	REFID=11940
Also		Thesis Nevis 145	C.Y. Chang	(COLU)	REFID=11859
BAZIN	65	PRL 14 154	M. Bazin *et al.*	(PRIN, COLU)	REFID=11851
BAZIN	65B	PR 140 B1358	M. Bazin *et al.*	(PRIN, RUTG, COLU)	REFID=11938
SCHMIDT	65	PR 140 B1328	P. Schmidt	(COLU)	REFID=11768
BHOWMIK	64	NP 53 22	B. Bhowmik *et al.*	(DELH)	REFID=11844
COURANT	64	PR 136 B1791	H. Courant *et al.*	(CERN, HEID, UMD+)	REFID=11846
NAUENBERG	64	PRL 12 679	U. Nauenberg *et al.*	(COLU, RUTG, PRIN)	REFID=11848
BARKAS	63	PRL 11 26	W.H. Barkas, J.N. Dyer, H.H. Heckman	(LRL)	REFID=10865
Also		Thesis UCRL 9450	J.N. Dyer	(LRL)	REFID=11843
GALTIERI	62	PRL 9 26	A. Barbaro-Galtieri *et al.*	(LRL)	REFID=11839
HUMPHREY	62	PR 127 1305	W.E. Humphrey, R.R. Ross	(LRL)	REFID=11743