Λ_c^+

$I(J^P) = 0(\frac{1}{2}^+)$ Status: ∗∗∗∗

The parity of the Λ_c^+ is defined to be positive (as are the parities of the proton, neutron, and Λ). The quark content is udc. Results of an analysis of $pK^-\pi^+$ decays (JEZABEK 92) are consistent with J = 1/2. Nobody doubts that the spin is indeed 1/2.

We have omitted some results that have been superseded by later experiments. The omitted results may be found in earlier editions.

Λ_c^+ MASS

Our value in 2004, 2284.9±0.6 MeV, was the average of the measurements now filed below as "not used." The BABAR measurement is so much better that we use it alone. Note that it is about 2.6 (old) standard deviations above the 2004 value.

The fit also includes Σ_c–Λ_c^+ and Λ_c^{*+}–Λ_c^+ mass-difference measurements, but this doesn't affect the Λ_c^+ mass. The new (in 2006) Λ_c^+ mass simply pushes all those other masses higher.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2286.46±0.14 OUR FIT					
2286.46±0.14	4891	[1] AUBERT,B	05S	BABR	$\Lambda K_S^0 K^+$ and $\Sigma^0 K_S^0 K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2284.7 ±0.6 ±0.7	1134	AVERY	91	CLEO	Six modes
2281.7 ±2.7 ±2.6	29	ALVAREZ	90B	NA14	$pK^-\pi^+$
2285.8 ±0.6 ±1.2	101	BARLAG	89	NA32	$pK^-\pi^+$
2284.7 ±2.3 ±0.5	5	AGUILAR-...	88B	LEBC	$pK^-\pi^+$
2283.1 ±1.7 ±2.0	628	ALBRECHT	88C	ARG	$pK^-\pi^+$, $p\overline{K}^0$, $\Lambda 3\pi$
2286.2 ±1.7 ±0.7	97	ANJOS	88B	E691	$pK^-\pi^+$
2281 ±3	2	JONES	87	HBC	$pK^-\pi^+$
2283 ±3	3	BOSETTI	82	HBC	$pK^-\pi^+$
2290 ±3	1	CALICCHIO	80	HYBR	$pK^-\pi^+$

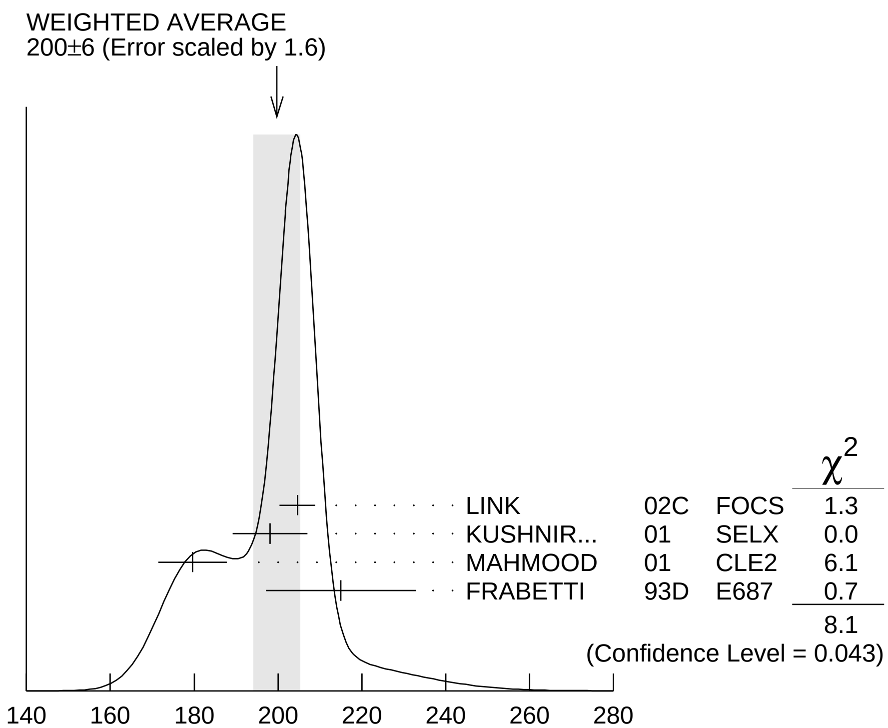
[1] AUBERT,B 05S uses low-Q $\Lambda K_S^0 K^+$ and $\Sigma^0 K_S^0 K^+$ decays to minimize systematic errors. The error above includes systematic as well as statistical errors. Many cross checks and adjustments to properties of the BABAR detector, as well as the large number of clean events, make this by far the best measurement of the Λ_c^+ mass.

Λ_c^+ MEAN LIFE

Measurements with an error $\geq$ 100 × 10^{-15} s or with fewer than 20 events have been omitted from the Listings.

VALUE (10^{-15} s)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
200 ± 6 OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.				
204.6± 3.4± 2.5	8034	LINK	02C	FOCS	$pK^-\pi^+$
198.1± 7.0± 5.6	1630	KUSHNIR...	01	SELX	$\Lambda_c^+ \rightarrow pK^-\pi^+$

179.6 ± 6.9 ± 4.4	4749	MAHMOOD	01	CLE2	$e^+ e^- \approx \Upsilon(4S)$
215 ± 16 ± 8	1340	FRABETTI	93D	E687	γ Be, $\Lambda_c^+ \to p K^- \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
180 ± 30 ± 30	29	ALVAREZ	90	NA14	γ, $\Lambda_c^+ \to p K^- \pi^+$
200 ± 30 ± 30	90	FRABETTI	90	E687	γ Be, $\Lambda_c^+ \to p K^- \pi^+$
196 $^{+23}_{-20}$	101	BARLAG	89	NA32	$p K^- \pi^+$ + c.c.
220 ± 30 ± 20	97	ANJOS	88B	E691	$p K^- \pi^+$ + c.c.



Λ_c^+ mean life

Λ_c^+ DECAY MODES

	Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Hadronic modes with a p: $S = -1$ final states			
Γ_1	$p K^0_S$		(1.58 ± 0.08) %	S=1.2
Γ_2	$p K^- \pi^+$		(6.35 ± 0.33) %	S=1.4
Γ_3	$p \overline{K}^*(892)^0$	[a]	(1.98 ± 0.28) %	
Γ_4	$\Delta(1232)^{++} K^-$		(1.09 ± 0.25) %	
Γ_5	$\Lambda(1520) \pi^+$	[a]	(2.2 ± 0.5) %	
Γ_6	$p K^- \pi^+$ nonresonant		(3.5 ± 0.4) %	
Γ_7	$p K^0_S \pi^0$		(1.99 ± 0.13) %	S=1.1
Γ_8	$p \overline{K}^0 \eta$		(1.6 ± 0.4) %	

Γ_{9}	$p K^0_S \pi^+ \pi^-$		(1.66± 0.12) %	S=1.1
Γ_{10}	$p K^- \pi^+ \pi^0$		(4.9 ± 0.4) %	S=1.3
Γ_{11}	$p K^*(892)^- \pi^+$	[a]	(1.5 ± 0.5) %	
Γ_{12}	$p (K^- \pi^+)_{\text{nonresonant}} \pi^0$		(4.6 ± 0.9) %	
Γ_{13}	$\Delta(1232) \overline{K}^*(892)$		seen	
Γ_{14}	$p K^- 2\pi^+ \pi^-$		(1.4 ± 1.0) $\times 10^{-3}$	
Γ_{15}	$p K^- \pi^+ 2\pi^0$		(1.0 ± 0.5) %	
Γ_{16}	$p K^- \pi^+ 3\pi^0$			

Hadronic modes with a p: $S = 0$ final states

Γ_{17}	$p \pi^+ \pi^-$		(4.3 ± 0.4) $\times 10^{-3}$	
Γ_{18}	$p f_0(980)$	[a]	(3.5 ± 2.3) $\times 10^{-3}$	
Γ_{19}	$p 2\pi^+ 2\pi^-$		(2.3 ± 1.5) $\times 10^{-3}$	
Γ_{20}	$p K^+ K^-$		(10 ± 4) $\times 10^{-4}$	
Γ_{21}	$p \phi$	[a]	(1.08± 0.14) $\times 10^{-3}$	
Γ_{22}	$p K^+ K^-$ non-ϕ		(5.3 ± 1.2) $\times 10^{-4}$	

Hadronic modes with a hyperon: $S = -1$ final states

Γ_{23}	$\Lambda \pi^+$		(1.30± 0.07) %	S=1.2
Γ_{24}	$\Lambda \pi^+ \pi^0$		(7.1 ± 0.4) %	S=1.2
Γ_{25}	$\Lambda \rho^+$		< 6 %	CL=95%
Γ_{26}	$\Lambda \pi^- 2\pi^+$		(3.7 ± 0.4) %	S=1.9
Γ_{27}	$\Sigma(1385)^+ \pi^+ \pi^-$, $\Sigma^{*+} \to \Lambda \pi^+$		(1.0 ± 0.5) %	
Γ_{28}	$\Sigma(1385)^- 2\pi^+$, $\Sigma^{*-} \to \Lambda \pi^-$		(7.8 ± 1.6) $\times 10^{-3}$	
Γ_{29}	$\Lambda \pi^+ \rho^0$		(1.5 ± 0.6) %	
Γ_{30}	$\Sigma(1385)^+ \rho^0$, $\Sigma^{*+} \to \Lambda \pi^+$		(5 ± 4) $\times 10^{-3}$	
Γ_{31}	$\Lambda \pi^- 2\pi^+$ nonresonant		< 1.1 %	CL=90%
Γ_{32}	$\Lambda \pi^- \pi^0 2\pi^+$ total		(2.3 ± 0.8) %	
Γ_{33}	$\Lambda \pi^+ \eta$	[a]	(2.3 ± 0.5) %	
Γ_{34}	$\Sigma(1385)^+ \eta$	[a]	(1.08± 0.32) %	
Γ_{35}	$\Lambda \pi^+ \omega$	[a]	(1.5 ± 0.5) %	
Γ_{36}	$\Lambda \pi^- \pi^0 2\pi^+$, no η or ω		< 8 $\times 10^{-3}$	CL=90%
Γ_{37}	$\Lambda K^+ \overline{K}^0$		(5.7 ± 1.1) $\times 10^{-3}$	S=2.0
Γ_{38}	$\Xi(1690)^0 K^+$, $\Xi^{*0} \to \Lambda \overline{K}^0$		(1.6 ± 0.5) $\times 10^{-3}$	
Γ_{39}	$\Sigma^0 \pi^+$		(1.29± 0.07) %	S=1.1
Γ_{40}	$\Sigma^+ \pi^0$		(1.24± 0.10) %	
Γ_{41}	$\Sigma^+ \eta$		(7.0 ± 2.3) $\times 10^{-3}$	
Γ_{42}	$\Sigma^+ \pi^+ \pi^-$		(4.57± 0.29) %	S=1.2
Γ_{43}	$\Sigma^+ \rho^0$		< 1.7 %	CL=95%
Γ_{44}	$\Sigma^- 2\pi^+$		(2.1 ± 0.4) %	
Γ_{45}	$\Sigma^0 \pi^+ \pi^0$		(2.3 ± 0.9) %	
Γ_{46}	$\Sigma^0 \pi^- 2\pi^+$		(1.13± 0.29) %	
Γ_{47}	$\Sigma^+ \pi^+ \pi^- \pi^0$		—	

Γ_{48}	$\Sigma^+ \omega$	[a]	(1.74 ± 0.21) %	
Γ_{49}	$\Sigma^+ K^+ K^-$		$(3.6 \pm 0.4) \times 10^{-3}$	
Γ_{50}	$\Sigma^+ \phi$	[a]	$(4.0 \pm 0.6) \times 10^{-3}$	S=1.1
Γ_{51}	$\Xi(1690)^0 K^+$, $\Xi^{*0} \to \Sigma^+ K^-$		$(1.03 \pm 0.26) \times 10^{-3}$	
Γ_{52}	$\Sigma^+ K^+ K^-$ nonresonant		$< 8 \times 10^{-4}$	CL=90%
Γ_{53}	$\Xi^0 K^+$		$(5.0 \pm 1.2) \times 10^{-3}$	
Γ_{54}	$\Xi^- K^+ \pi^+$		$(6.2 \pm 0.6) \times 10^{-3}$	S=1.1
Γ_{55}	$\Xi(1530)^0 K^+$	[a]	$(3.3 \pm 0.9) \times 10^{-3}$	
	Hadronic modes with a hyperon: $S = 0$ final states			
Γ_{56}	ΛK^+		$(6.1 \pm 1.2) \times 10^{-4}$	
Γ_{57}	$\Lambda K^+ \pi^+ \pi^-$		$< 5 \times 10^{-4}$	CL=90%
Γ_{58}	$\Sigma^0 K^+$		$(5.2 \pm 0.8) \times 10^{-4}$	
Γ_{59}	$\Sigma^0 K^+ \pi^+ \pi^-$		$< 2.6 \times 10^{-4}$	CL=90%
Γ_{60}	$\Sigma^+ K^+ \pi^-$		$(2.1 \pm 0.6) \times 10^{-3}$	
Γ_{61}	$\Sigma^+ K^*(892)^0$	[a]	$(3.6 \pm 1.0) \times 10^{-3}$	
Γ_{62}	$\Sigma^- K^+ \pi^+$		$< 1.2 \times 10^{-3}$	CL=90%
	Doubly Cabibbo-suppressed modes			
Γ_{63}	$p K^+ \pi^-$		$(1 \pm 13) \times 10^{-4}$	
	Semileptonic modes			
Γ_{64}	$\Lambda e^+ \nu_e$		(3.6 ± 0.4) %	
Γ_{65}	$\Lambda \mu^+ \nu_\mu$			
	Inclusive modes			
Γ_{66}	e^+ anything		(4.5 ± 1.7) %	
Γ_{67}	$p e^+$ anything		(1.8 ± 0.9) %	
Γ_{68}	Λe^+ anything			
Γ_{69}	p anything		(50 ± 16) %	
Γ_{70}	p anything (no Λ)		(12 ± 19) %	
Γ_{71}	p hadrons			
Γ_{72}	n anything		(50 ± 16) %	
Γ_{73}	n anything (no Λ)		(29 ± 17) %	
Γ_{74}	Λ anything		(35 ± 11) %	S=1.4
Γ_{75}	$\Sigma^\pm$ anything	[b]	(10 ± 5) %	
Γ_{76}	3prongs		(24 ± 8) %	
	$\Delta C = 1$ weak neutral current (*C1*) modes, or Lepton Family number (*LF*), or Lepton number (*L*), or Baryon number (*B*) violating modes			
Γ_{77}	$p e^+ e^-$	*C1*	$< 5.5 \times 10^{-6}$	CL=90%
Γ_{78}	$p \mu^+ \mu^-$	*C1*	$< 4.4 \times 10^{-5}$	CL=90%
Γ_{79}	$p e^+ \mu^-$	*LF*	$< 9.9 \times 10^{-6}$	CL=90%
Γ_{80}	$p e^- \mu^+$	*LF*	$< 1.9 \times 10^{-5}$	CL=90%

Γ_{81}	$\overline{p} 2e^+$	*L*,*B*	$<$ 2.7	$\times 10^{-6}$	CL=90%
Γ_{82}	$\overline{p} 2\mu^+$	*L*,*B*	$<$ 9.4	$\times 10^{-6}$	CL=90%
Γ_{83}	$\overline{p} e^+ \mu^+$	*L*,*B*	$<$ 1.6	$\times 10^{-5}$	CL=90%
Γ_{84}	$\Sigma^- \mu^+ \mu^+$	*L*	$<$ 7.0	$\times 10^{-4}$	CL=90%

[*a*] This branching fraction includes all the decay modes of the final-state resonance.

[*b*] The value is for the sum of the charge states or particle/antiparticle states indicated.

CONSTRAINED FIT INFORMATION

An overall fit to 36 branching ratios uses 57 measurements and one constraint to determine 19 parameters. The overall fit has a $\chi^2 = 39.9$ for 39 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, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

	x_1	x_2	x_7	x_9	x_{10}	x_{23}	x_{24}	x_{26}	x_{37}	x_{39}
x_2	50									
x_7	43	59								
x_9	48	57	37							
x_{10}	30	83	48	54						
x_{23}	46	72	47	36	53					
x_{24}	37	66	44	31	52	69				
x_{26}	53	13	13	44	9	15	6			
x_{37}	14	24	15	13	18	27	20	4		
x_{39}	49	58	40	36	42	74	59	28	20	
x_{40}	36	42	32	25	30	35	34	14	11	31
x_{42}	42	79	48	52	72	54	52	18	18	45
x_{44}	15	29	17	17	24	20	19	4	7	17
x_{46}	17	11	8	15	9	9	7	25	3	11
x_{48}	19	31	19	24	29	20	19	13	7	17
x_{49}	22	41	25	26	37	28	27	9	9	24
x_{50}	17	33	20	22	30	23	22	8	8	19
x_{54}	26	43	27	22	33	53	38	8	15	40

x_{42}	34						
x_{44}	12	26					
x_{46}	7	11	3				
x_{48}	15	28	9	6			
x_{49}	18	49	13	5	14		
x_{50}	14	42	11	4	12	20	
x_{54}	20	33	12	5	12	17	14
	x_{40}	x_{42}	x_{44}	x_{46}	x_{48}	x_{49}	x_{50}

Λ_c^+ BRANCHING RATIOS

A few really obsolete results have been omitted.

Hadronic modes with a p: $S = -1$ final states

$\Gamma(pK_S^0)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.58±0.08 OUR FIT Error includes scale factor of 1.2.					
1.52±0.08±0.03	1243	ABLIKIM	16	BES3	$e^+e^- \to \Lambda_c \overline{\Lambda}_c$, 4.599 GeV

$\Gamma(pK_S^0)/\Gamma(pK^-\pi^+)$ Γ_1/Γ_2

Measurements given as a $\overline{K}^0$ ratio have been divided by 2 to convert to a K_S^0 ratio.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.249±0.013 OUR FIT Error includes scale factor of 1.5.					
0.234±0.020 OUR AVERAGE					
0.23 ±0.01 ±0.02	1025	ALAM	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
0.22 ±0.04 ±0.03	133	AVERY	91	CLEO	e^+e^- 10.5 GeV
0.28 ±0.09 ±0.07	45	ANJOS	90	E691	γ Be 70–260 GeV
0.31 ±0.08 ±0.02	73	ALBRECHT	88C	ARG	e^+e^- 10 GeV

$\Gamma(pK^-\pi^+)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
6.35±0.33 OUR FIT Error includes scale factor of 1.4.					
6.3 ±0.5 OUR AVERAGE Error includes scale factor of 2.0.					
5.84±0.27±0.23	6.3k	ABLIKIM	16	BES3	$e^+e^- \to \Lambda_c \overline{\Lambda}_c$, 4.599 GeV
$6.84\pm0.24^{+0.21}_{-0.27}$	1.4k	[1] ZUPANC	14	BELL	$e^+e^- \to D^{(*)-}\overline{p}\pi^+$ recoil
• • • We do not use the following data for averages, fits, limits, etc. • • •					
5.0 ±1.3		[2] PDG	02		See footnote

[1] This ZUPANC 14 value is the FIRST-EVER model-independent measurement of a Λ_c^+ branching fraction.

[2] See the note by P. Burchat, "Λ_c^+ Branching Fractions," in any edition of the Review from 2002 through 2014 for how this value was obtained. It is now obsolete.

$\Gamma(p\overline{K}^*(892)^0)/\Gamma(pK^-\pi^+)$ — Γ_3/Γ_2

Unseen decay modes of the $\overline{K}^*(892)^0$ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.31±0.04 OUR AVERAGE					
$0.29\pm0.04\pm0.03$		[1] AITALA	00	E791	$\pi^- N$, 500 GeV
$0.35^{+0.06}_{-0.07}\pm0.03$	39	BOZEK	93	NA32	π^- Cu 230 GeV
0.42 ± 0.24	12	BASILE	81B	CNTR	$pp \to \Lambda_c^+ e^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.35 ± 0.11		BARLAG	90D	NA32	See BOZEK 93

[1] AITALA 00 makes a coherent 5-dimensional amplitude analysis of 946 ± 38 $\Lambda_c^+ \to pK^-\pi^+$ decays.

$\Gamma(\Delta(1232)^{++}K^-)/\Gamma(pK^-\pi^+)$ — Γ_4/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.17±0.04 OUR AVERAGE	Error includes scale factor of 1.1.				
$0.18\pm0.03\pm0.03$		[1] AITALA	00	E791	$\pi^- N$, 500 GeV
$0.12^{+0.04}_{-0.05}\pm0.05$	14	BOZEK	93	NA32	π^- Cu 230 GeV
0.40 ± 0.17	17	BASILE	81B	CNTR	$pp \to \Lambda_c^+ e^- X$

[1] AITALA 00 makes a coherent 5-dimensional amplitude analysis of 946 ± 38 $\Lambda_c^+ \to pK^-\pi^+$ decays.

$\Gamma(\Lambda(1520)\pi^+)/\Gamma(pK^-\pi^+)$ — Γ_5/Γ_2

Unseen decay modes of the $\Lambda(1520)$ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.35±0.08 OUR AVERAGE					
$0.34\pm0.08\pm0.05$		[1] AITALA	00	E791	$\pi^- N$, 500 GeV
$0.40^{+0.18}_{-0.13}\pm0.09$	12	BOZEK	93	NA32	π^- Cu 230 GeV

[1] AITALA 00 makes a coherent 5-dimensional amplitude analysis of 946 ± 38 $\Lambda_c^+ \to pK^-\pi^+$ decays.

$\Gamma(pK^-\pi^+\text{nonresonant})/\Gamma(pK^-\pi^+)$ — Γ_6/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.55±0.06 OUR AVERAGE					
$0.55\pm0.06\pm0.04$		[1] AITALA	00	E791	$\pi^- N$, 500 GeV
$0.56^{+0.07}_{-0.09}\pm0.05$	71	BOZEK	93	NA32	π^- Cu 230 GeV

[1] AITALA 00 makes a coherent 5-dimensional amplitude analysis of 946 ± 38 $\Lambda_c^+ \to pK^-\pi^+$ decays.

$\Gamma(pK^0_S\pi^0)/\Gamma_{\text{total}}$ — Γ_7/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.99±0.13 OUR FIT	Error includes scale factor of 1.1.				
1.87±0.13±0.05	558	ABLIKIM	16	BES3	$e^+e^- \to \Lambda_c\overline{\Lambda}_c$, 4.599 GeV

$\Gamma(pK^0_S\pi^0)/\Gamma(pK^-\pi^+)$ — Γ_7/Γ_2

Measurements given as a $\overline{K}^0$ ratio have been divided by 2 to convert to a K^0_S ratio.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.313±0.018 OUR FIT					
0.33 ±0.03 ±0.04	774	ALAM	98	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(p\overline{K}^0\eta)/\Gamma(pK^-\pi^+)$ — Γ_8/Γ_2

Unseen decay modes of the η are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.25±0.04±0.04	57	AMMAR	95	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(pK^0_S\pi^+\pi^-)/\Gamma_{total}$ — Γ_9/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.66±0.12 OUR FIT Error includes scale factor of 1.1.					
1.53±0.11±0.09	485	ABLIKIM	16	BES3	$e^+e^- \to \Lambda_c\overline{\Lambda}_c$, 4.599 GeV

$\Gamma(pK^0_S\pi^+\pi^-)/\Gamma(pK^-\pi^+)$ — Γ_9/Γ_2

Measurements given as a $\overline{K}^0$ ratio have been divided by 2 to convert to a K^0_S ratio.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.261±0.016 OUR FIT Error includes scale factor of 1.2.					
0.257±0.031 OUR AVERAGE					
0.26 ±0.02 ±0.03	985	ALAM	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
0.22 ±0.06 ±0.02	83	AVERY	91	CLEO	e^+e^- 10.5 GeV
0.49 ±0.18 ±0.04	12	BARLAG	90D	NA32	π^- 230 GeV

$\Gamma(pK^-\pi^+\pi^0)/\Gamma_{total}$ — Γ_{10}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
4.9 ±0.4 OUR FIT Error includes scale factor of 1.3.					
4.53±0.23±0.30	1849	ABLIKIM	16	BES3	$e^+e^- \to \Lambda_c\overline{\Lambda}_c$, 4.599 GeV

$\Gamma(pK^-\pi^+\pi^0)/\Gamma(pK^-\pi^+)$ — Γ_{10}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.777±0.033 OUR FIT Error includes scale factor of 1.1.					
0.67 ±0.04 ±0.11	2606	ALAM	98	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(pK^*(892)^-\pi^+)/\Gamma(pK^0_S\pi^+\pi^-)$ — Γ_{11}/Γ_9

Unseen decay modes of the $K^*(892)^-$ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.88±0.28	17	ALEEV	94	BIS2	nN 20–70 GeV

$\Gamma(p(K^-\pi^+)_{nonresonant}\pi^0)/\Gamma(pK^-\pi^+)$ — Γ_{12}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.73±0.12±0.05	67	BOZEK	93	NA32	π^- Cu 230 GeV

$\Gamma(\Delta(1232)\overline{K}^*(892))/\Gamma_{total}$ — Γ_{13}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	35	AMENDOLIA	87	SPEC	γ Ge-Si

$\Gamma(pK^-2\pi^+\pi^-)/\Gamma(pK^-\pi^+)$ — Γ_{14}/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
0.022±0.015	BARLAG	90D	NA32	π^- 230 GeV

$\Gamma(pK^-\pi^+2\pi^0)/\Gamma(pK^-\pi^+)$ — Γ_{15}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.16±0.07±0.03	15	BOZEK	93	NA32	π^- Cu 230 GeV

$\Gamma(pK^-\pi^+3\pi^0)/\Gamma(pK^-\pi^+)$ — Γ_{16}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.10±0.06±0.02	8	BOZEK	93	NA32	π^- Cu 230 GeV

Hadronic modes with a p: $S = 0$ final states

$\Gamma(p\pi^+\pi^-)/\Gamma(pK^-\pi^+)$ — Γ_{17}/Γ_2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
6.7 ±0.5 OUR AVERAGE					
6.70±0.48±0.25	495	ABLIKIM	16U	BES3	e^+e^- at 4.599 GeV
6.9 ±3.6	5	BARLAG	90D	NA32	π^- 230 GeV

$\Gamma(pf_0(980))/\Gamma(pK^-\pi^+)$ — Γ_{18}/Γ_2

Unseen decay modes of the $f_0(980)$ are included.

VALUE	DOCUMENT ID		TECN	COMMENT
0.055±0.036	BARLAG	90D	NA32	π^- 230 GeV

$\Gamma(p2\pi^+2\pi^-)/\Gamma(pK^-\pi^+)$ — Γ_{19}/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
0.036±0.023	BARLAG	90D	NA32	π^- 230 GeV

$\Gamma(pK^+K^-)/\Gamma(pK^-\pi^+)$ — Γ_{20}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.015±0.006 OUR AVERAGE Error includes scale factor of 2.1.					
0.014±0.002±0.002	676	ABE	02C	BELL	$e^+e^- \approx \Upsilon(4S)$
0.039±0.009±0.007	214	ALEXANDER	96C	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.096±0.029±0.010	30	FRABETTI	93H	E687	γBe, $\overline{E}_\gamma$ 220 GeV
0.048±0.027		BARLAG	90D	NA32	π^- 230 GeV

$\Gamma(p\phi)/\Gamma(pK^-\pi^+)$ — Γ_{21}/Γ_2

Unseen decay modes of the ϕ are included.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.70±0.21 OUR AVERAGE					
1.81±0.33±0.13	44	ABLIKIM	16U	BES3	e^+e^- at 4.599 GeV
1.5 ±0.2 ±0.2	345	ABE	02C	BELL	$e^+e^- \approx \Upsilon(4S)$
2.4 ±0.6 ±0.3	54	ALEXANDER	96C	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.0 ±2.7		BARLAG	90D	NA32	π^- 230 GeV

$\Gamma(pK^+K^- \text{non-}\phi)/\Gamma(pK^-\pi^+)$ — Γ_{22}/Γ_2

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
8.4 ±1.8 OUR AVERAGE					
9.36±2.22±0.71	38	ABLIKIM	16U	BES3	e^+e^- at 4.599 GeV
7 ±2 ±2	344	ABE	02C	BELL	$e^+e^- \approx \Upsilon(4S)$

Hadronic modes with a hyperon: $S = -1$ final states

$\Gamma(\Lambda\pi^+)/\Gamma_{total}$ — Γ_{23}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.30±0.07 OUR FIT Error includes scale factor of 1.2.					
1.24±0.07±0.03	706	ABLIKIM	16	BES3	$e^+e^- \rightarrow \Lambda_c\overline{\Lambda}_c$, 4.599 GeV

$\Gamma(\Lambda\pi^+)/\Gamma(pK^-\pi^+)$ — Γ_{23}/Γ_2

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.204±0.009 OUR FIT Error includes scale factor of 1.1.						
0.204±0.019 OUR AVERAGE						
0.217±0.013±0.020		750	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
0.18 ±0.03 ±0.04			ALBRECHT	92	ARG	$e^+e^- \approx$ 10.4 GeV
0.18 ±0.03 ±0.03		87	AVERY	91	CLEO	e^+e^- 10.5 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.33	90		ANJOS	90	E691	γBe 70–260 GeV
<0.16	90		ALBRECHT	88C	ARG	e^+e^- 10 GeV

$\Gamma(\Lambda\pi^+\pi^0)/\Gamma_{total}$ — Γ_{24}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
7.1 ±0.4 OUR FIT Error includes scale factor of 1.2.					
7.01±0.37±0.19	1497	ABLIKIM	16	BES3	$e^+e^- \rightarrow \Lambda_c\overline{\Lambda}_c$, 4.599 GeV

$\Gamma(\Lambda\pi^+\pi^0)/\Gamma(pK^-\pi^+)$ — Γ_{24}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.11±0.05 OUR FIT Error includes scale factor of 1.1.					
0.73±0.09±0.16	464	AVERY	94	CLE2	$e^+e^- \approx \Upsilon(3S), \Upsilon(4S)$

$\Gamma(\Lambda\rho^+)/\Gamma(pK^-\pi^+)$ — Γ_{25}/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.95	95	AVERY	94	CLE2	$e^+e^- \approx \Upsilon(3S), \Upsilon(4S)$

$\Gamma(\Lambda\pi^-2\pi^+)/\Gamma_{total}$ — Γ_{26}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
3.7 ±0.4 OUR FIT Error includes scale factor of 1.9.					
3.81±0.24±0.18	609	ABLIKIM	16	BES3	$e^+e^- \rightarrow \Lambda_c\overline{\Lambda}_c$, 4.599 GeV

$\Gamma(\Lambda\pi^-2\pi^+)/\Gamma(pK^-\pi^+)$ — Γ_{26}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.58 ±0.06 OUR FIT Error includes scale factor of 2.8.					
0.522±0.032 OUR AVERAGE					
0.508±0.024±0.024	1356	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
0.65 ±0.11 ±0.12	289	AVERY	91	CLEO	e^+e^- 10.5 GeV
0.82 ±0.29 ±0.27	44	ANJOS	90	E691	γBe 70–260 GeV
0.94 ±0.41 ±0.13	10	BARLAG	90D	NA32	π^- 230 GeV
0.61 ±0.16 ±0.04	105	ALBRECHT	88C	ARG	e^+e^- 10 GeV

$\Gamma(\Sigma(1385)^+\pi^+\pi^-, \Sigma^{*+} \to \Lambda\pi^+)/\Gamma(\Lambda\pi^- 2\pi^+)$ — Γ_{27}/Γ_{26}

VALUE	DOCUMENT ID		TECN	COMMENT
0.28±0.10±0.08	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(\Sigma(1385)^- 2\pi^+, \Sigma^{*-} \to \Lambda\pi^-)/\Gamma(\Lambda\pi^- 2\pi^+)$ — Γ_{28}/Γ_{26}

VALUE	DOCUMENT ID		TECN	COMMENT
0.21±0.03±0.02	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(\Lambda\pi^+\rho^0)/\Gamma(\Lambda\pi^- 2\pi^+)$ — Γ_{29}/Γ_{26}

VALUE	DOCUMENT ID		TECN	COMMENT
0.40±0.12±0.12	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(\Sigma(1385)^+\rho^0, \Sigma^{*+} \to \Lambda\pi^+)/\Gamma(\Lambda\pi^- 2\pi^+)$ — Γ_{30}/Γ_{26}

VALUE	DOCUMENT ID		TECN	COMMENT
0.14±0.09±0.07	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(\Lambda\pi^- 2\pi^+ \text{ nonresonant})/\Gamma(\Lambda\pi^- 2\pi^+)$ — Γ_{31}/Γ_{26}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.3	90	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(\Lambda\pi^-\pi^0 2\pi^+ \text{ total})/\Gamma(pK^-\pi^+)$ — Γ_{32}/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.36±0.09±0.09	50	[1] CRONIN-HEN..03	CLE3	$e^+e^- \approx \Upsilon(4S)$

[1] CRONIN-HENNESSY 03 finds this channel to be dominantly $\Lambda\eta\pi^+$ and $\Lambda\omega\pi^+$; see below.

$\Gamma(\Lambda\pi^+\eta)/\Gamma(pK^-\pi^+)$ — Γ_{33}/Γ_2

Unseen decay modes of the η are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.36±0.07 OUR AVERAGE					
0.41±0.17±0.10	11	CRONIN-HEN..03		CLE3	$e^+e^- \approx \Upsilon(4S)$
0.35±0.05±0.06	116	AMMAR	95	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma(1385)^+\eta)/\Gamma(pK^-\pi^+)$ — Γ_{34}/Γ_2

Unseen decay modes of the $\Sigma(1385)^+$ and η are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.17±0.04±0.03	54	AMMAR	95	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Lambda\pi^+\omega)/\Gamma(pK^-\pi^+)$ — Γ_{35}/Γ_2

Unseen decay modes of the ω are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.24±0.06±0.06	32	CRONIN-HEN..03	CLE3	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Lambda\pi^-\pi^0 2\pi^+, \text{ no } \eta \text{ or } \omega)/\Gamma(pK^-\pi^+)$ — Γ_{36}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.13	90	CRONIN-HEN..03	CLE3	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Lambda K^+ \overline{K}^0)/\Gamma(p K^- \pi^+)$ — Γ_{37}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.089±0.018 OUR FIT Error includes scale factor of 2.0.					
0.131±0.020 OUR AVERAGE					
0.142±0.018±0.022	251	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV
0.12 ±0.02 ±0.02	59	AMMAR	95	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Xi(1690)^0 K^+, \Xi^{*0} \to \Lambda \overline{K}^0)/\Gamma(\Lambda K^+ \overline{K}^0)$ — Γ_{38}/Γ_{37}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.28±0.07 OUR AVERAGE					
0.32±0.10±0.04	84±24	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV
0.26±0.08±0.03	93	ABE	02C	BELL	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Lambda K^+ \overline{K}^0)/\Gamma(\Lambda \pi^+)$ — Γ_{37}/Γ_{23}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.44 ±0.08 OUR FIT Error includes scale factor of 2.1.					
0.395±0.026±0.036	460 ± 30	AUBERT	07U	BABR	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^0 \pi^+)/\Gamma_{total}$ — Γ_{39}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.29±0.07 OUR FIT Error includes scale factor of 1.1.					
1.27±0.08±0.03	522	ABLIKIM	16	BES3	$e^+ e^- \to \Lambda_c \overline{\Lambda}_c$, 4.599 GeV

$\Gamma(\Sigma^0 \pi^+)/\Gamma(p K^- \pi^+)$ — Γ_{39}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.203±0.010 OUR FIT Error includes scale factor of 1.2.					
0.20 ±0.04 OUR AVERAGE					
0.21 ±0.02 ±0.04	196	AVERY	94	CLE2	$e^+ e^- \approx \Upsilon(3S), \Upsilon(4S)$
0.17 ±0.06 ±0.04		ALBRECHT	92	ARG	$e^+ e^- \approx 10.4$ GeV

$\Gamma(\Sigma^0 \pi^+)/\Gamma(\Lambda \pi^+)$ — Γ_{39}/Γ_{23}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.99 ±0.04 OUR FIT Error includes scale factor of 1.1.					
0.98 ±0.05 OUR AVERAGE					
0.977±0.015±0.051	33k	AUBERT	07U	BABR	$e^+ e^- \approx \Upsilon(4S)$
1.09 ±0.11 ±0.19	750	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(\Sigma^+ \pi^0)/\Gamma_{total}$ — Γ_{40}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.24±0.10 OUR FIT					
1.18±0.10±0.03	309	ABLIKIM	16	BES3	$e^+ e^- \to \Lambda_c \overline{\Lambda}_c$, 4.599 GeV

$\Gamma(\Sigma^+ \pi^0)/\Gamma(p K^- \pi^+)$ — Γ_{40}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.196±0.015 OUR FIT					
0.20 ±0.03 ±0.03	93	KUBOTA	93	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^+ \eta)/\Gamma(p K^- \pi^+)$ — Γ_{41}/Γ_2

Unseen decay modes of the η are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.11±0.03±0.02	26	AMMAR	95	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^+ \pi^+ \pi^-)/\Gamma_{total}$ — Γ_{42}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
4.57±0.29 OUR FIT Error includes scale factor of 1.2.					
4.25±0.24±0.20	1156	ABLIKIM	16	BES3	$e^+ e^- \to \Lambda_c \overline{\Lambda}_c$, 4.599 GeV

$\Gamma(\Sigma^+ \pi^+ \pi^-)/\Gamma(p K^- \pi^+)$ — Γ_{42}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.720±0.029 OUR FIT Error includes scale factor of 1.1.					
0.69 ±0.08 OUR AVERAGE					
0.72 ±0.14	47 ± 9	VAZQUEZ-JA...	08	SELX	Σ^- nucleus, 600 GeV
0.74 ±0.07 ±0.09	487	KUBOTA	93	CLE2	$e^+ e^- \approx \Upsilon(4S)$
$0.54\ ^{+0.18}_{-0.15}$	11	BARLAG	92	NA32	π^- Cu 230 GeV

$\Gamma(\Sigma^+ \rho^0)/\Gamma(p K^- \pi^+)$ — Γ_{43}/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.27	95	KUBOTA	93	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^- 2\pi^+)/\Gamma(p K^- \pi^+)$ — Γ_{44}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.33 ±0.06 OUR FIT					
0.314±0.067	30 ± 6	VAZQUEZ-JA...	08	SELX	Σ^- nucleus, 600 GeV

$\Gamma(\Sigma^- 2\pi^+)/\Gamma(\Sigma^+ \pi^+ \pi^-)$ — Γ_{44}/Γ_{42}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.46±0.08 OUR FIT					
0.53±0.15±0.07	56	FRABETTI	94E	E687	γ Be, $\overline{E}_\gamma$ 220 GeV

$\Gamma(\Sigma^0 \pi^+ \pi^0)/\Gamma(p K^- \pi^+)$ — Γ_{45}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.36±0.09±0.10	117	AVERY	94	CLE2	$e^+ e^- \approx \Upsilon(3S), \Upsilon(4S)$

$\Gamma(\Sigma^0 \pi^- 2\pi^+)/\Gamma(p K^- \pi^+)$ — Γ_{46}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.18±0.05 OUR FIT					
0.21±0.05±0.05	90	AVERY	94	CLE2	$e^+ e^- \approx \Upsilon(3S), \Upsilon(4S)$

$\Gamma(\Sigma^0 \pi^- 2\pi^+)/\Gamma(\Lambda \pi^- 2\pi^+)$ — Γ_{46}/Γ_{26}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.30±0.08 OUR FIT					
0.26±0.06±0.09	480	LINK	05F	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(\Sigma^+ \omega)/\Gamma_{total}$ — Γ_{48}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.74±0.21 OUR FIT					
1.56±0.20±0.07	157	ABLIKIM	16	BES3	$e^+ e^- \to \Lambda_c \overline{\Lambda}_c$, 4.599 GeV

$\Gamma(\Sigma^+\omega)/\Gamma(pK^-\pi^+)$ — Γ_{48}/Γ_2

Unseen decay modes of the ω are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.274±0.032 OUR FIT					
0.54 ±0.13 ±0.06	107	KUBOTA	93	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^+K^+K^-)/\Gamma(pK^-\pi^+)$ — Γ_{49}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.056±0.006 OUR FIT					
0.070±0.011±0.011	59	AVERY	93	CLE2	$e^+e^- \approx 10.5$ GeV

$\Gamma(\Sigma^+K^+K^-)/\Gamma(\Sigma^+\pi^+\pi^-)$ — Γ_{49}/Γ_{42}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.078±0.008 OUR FIT					
0.074±0.009 OUR AVERAGE					
0.076±0.007±0.009	246	ABE	02C	BELL	$e^+e^- \approx \Upsilon(4S)$
0.071±0.011±0.011	103	LINK	02G	FOCS	γ nucleus, ≈ 180 GeV

$\Gamma(\Sigma^+\phi)/\Gamma(pK^-\pi^+)$ — Γ_{50}/Γ_2

Unseen decay modes of the ϕ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.063±0.009 OUR FIT	Error includes scale factor of 1.1.				
0.069±0.023±0.016	26	AVERY	93	CLE2	$e^+e^- \approx 10.5$ GeV

$\Gamma(\Sigma^+\phi)/\Gamma(\Sigma^+\pi^+\pi^-)$ — Γ_{50}/Γ_{42}

Unseen decay modes of the ϕ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.087±0.012 OUR FIT					
0.086±0.012 OUR AVERAGE					
0.085±0.012±0.012	129	ABE	02C	BELL	$e^+e^- \approx \Upsilon(4S)$
0.087±0.016±0.006	57	LINK	02G	FOCS	γ nucleus, ≈ 180 GeV

$\Gamma(\Xi(1690)^0K^+, \Xi^{*0} \to \Sigma^+K^-)/\Gamma(\Sigma^+\pi^+\pi^-)$ — Γ_{51}/Γ_{42}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.023±0.005 OUR AVERAGE					
0.023±0.005±0.005	75	ABE	02C	BELL	$e^+e^- \approx \Upsilon(4S)$
0.022±0.006±0.006	34	LINK	02G	FOCS	γ nucleus, ≈ 180 GeV

$\Gamma(\Sigma^+K^+K^-$ nonresonant$)/\Gamma(\Sigma^+\pi^+\pi^-)$ — Γ_{52}/Γ_{42}

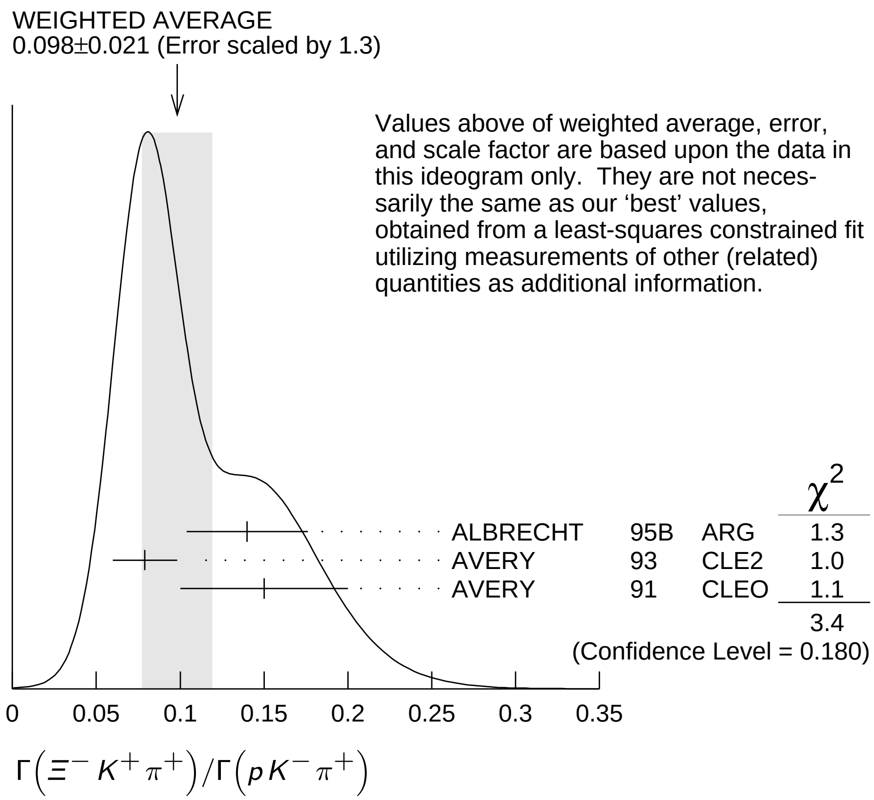
VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.018	90	ABE	02C	BELL	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.028	90	LINK	02G	FOCS	γ nucleus, ≈ 180 GeV

$\Gamma(\Xi^0K^+)/\Gamma(pK^-\pi^+)$ — Γ_{53}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.078±0.013±0.013	56	AVERY	93	CLE2	$e^+e^- \approx 10.5$ GeV

$\Gamma(\Xi^- K^+ \pi^+)/\Gamma(p K^- \pi^+)$ — Γ_{54}/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.098±0.009 OUR FIT Error includes scale factor of 1.1.					
0.098±0.021 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.					
0.14 ±0.03 ±0.02	34	ALBRECHT	95B	ARG	$e^+ e^- \approx 10.4$ GeV
0.079±0.013±0.014	60	AVERY	93	CLE2	$e^+ e^- \approx 10.5$ GeV
0.15 ±0.04 ±0.03	30	AVERY	91	CLEO	$e^+ e^-$ 10.5 GeV



$\Gamma(\Xi(1530)^0 K^+)/\Gamma(p K^- \pi^+)$ — Γ_{55}/Γ_2

Unseen decay modes of the $\Xi(1530)^0$ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.052±0.014 OUR AVERAGE					
0.05 ±0.02 ±0.01	11	ALBRECHT	95B	ARG	$e^+ e^- \approx 10.4$ GeV
0.053±0.016±0.010	24	AVERY	93	CLE2	$e^+ e^- \approx 10.5$ GeV

$\Gamma(\Xi^- K^+ \pi^+)/\Gamma(\Lambda \pi^+)$ — Γ_{54}/Γ_{23}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.48 ±0.04 OUR FIT					
0.480±0.016±0.039	2665 ± 84	AUBERT	07U	BABR	$e^+ e^- \approx \Upsilon(4S)$

Hadronic modes with a hyperon: $S = 0$ final states

$\Gamma(\Lambda K^+)/\Gamma(\Lambda \pi^+)$ — Γ_{56}/Γ_{23}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.047±0.009 OUR AVERAGE Error includes scale factor of 1.8.					
0.044±0.004±0.003	1162 ± 101	AUBERT	07U	BABR	$e^+ e^- \approx \Upsilon(4S)$
0.074±0.010±0.012	265	ABE	02C	BELL	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Lambda K^+\pi^+\pi^-)/\Gamma(\Lambda\pi^+)$ — Γ_{57}/Γ_{23}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<4.1 × 10^{-2}	90	AUBERT	07U	BABR	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^0 K^+)/\Gamma(\Sigma^0\pi^+)$ — Γ_{58}/Γ_{39}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.040±0.006 OUR AVERAGE					
0.038±0.005±0.003	366 ± 52	AUBERT	07U	BABR	$e^+e^- \approx \Upsilon(4S)$
0.056±0.014±0.008	75	ABE	02C	BELL	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^0 K^+\pi^+\pi^-)/\Gamma(\Sigma^0\pi^+)$ — Γ_{59}/Γ_{39}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.0 × 10^{-2}	90	AUBERT	07U	BABR	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^+ K^+\pi^-)/\Gamma(\Sigma^+\pi^+\pi^-)$ — Γ_{60}/Γ_{42}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.047±0.011±0.008	105	ABE	02C	BELL	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^+ K^*(892)^0)/\Gamma(\Sigma^+\pi^+\pi^-)$ — Γ_{61}/Γ_{42}

Unseen decay modes of the $K^*(892)^0$ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.078±0.018±0.013	49	LINK	02G	FOCS	γ nucleus, ≈ 180 GeV

$\Gamma(\Sigma^- K^+\pi^+)/\Gamma(\Sigma^+ K^*(892)^0)$ — Γ_{62}/Γ_{61}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.35	90	LINK	02G	FOCS	γ nucleus, ≈ 180 GeV

Doubly Cabibbo-suppressed modes

$\Gamma(pK^+\pi^-)/\Gamma(pK^-\pi^+)$ — Γ_{63}/Γ_2

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
2.35±0.27±021		3379	YANG	16	BELL	At or near Υs
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<4.6	90		[1] LINK	05K	FOCS	180 GeV γ on BeO

[1] LINK 05K limit is equivalent to (0.05 ± 0.26 ± 0.02)% measurement.

Semileptonic modes

$\Gamma(\Lambda e^+\nu_e)/\Gamma_{total}$ — Γ_{64}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
3.63±0.38±0.20	104	ABLIKIM	15Y	BES3	567 pb^{-1}, 4.599 GeV

$\Gamma(\Lambda e^+\nu_e)/\Gamma(pK^-\pi^+)$ — Γ_{64}/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.43±0.08	[1,2] BERGFELD	94	CLE2	$e^+e^- \approx \Upsilon(4S)$
0.38±0.14	[2,3] ALBRECHT	91G	ARG	$e^+e^- \approx$ 10.4 GeV

[1] BERGFELD 94 measures $\sigma(e^+e^- \rightarrow \Lambda_c^+ X)\cdot B(\Lambda_c^+ \rightarrow \Lambda e^+ \nu_e) = (4.87 \pm 0.28 \pm 0.69)$ pb.

[2] To extract $\Gamma(\Lambda_c^+ \rightarrow \Lambda e^+ \nu_e)/\Gamma(\Lambda_c^+ \rightarrow pK^-\pi^+)$, we use $\sigma(e^+e^- \rightarrow \Lambda_c^+ X)\cdot B(\Lambda_c \rightarrow pK^-\pi^+) = (11.2 \pm 1.3)$ pb, which is the weighted average of measurements from ARGUS (ALBRECHT 96E) and CLEO (AVERY 91).

[3] ALBRECHT 91G measures $\sigma(e^+e^- \rightarrow \Lambda_c^+ X)\cdot B(\Lambda_c^+ \rightarrow \Lambda e^+ \nu_e) = (4.20 \pm 1.28 \pm 0.71)$ pb.

$\Gamma(\Lambda\mu^+\nu_\mu)/\Gamma(pK^-\pi^+)$ — Γ_{65}/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.40 ± 0.09	[1,2] BERGFELD	94	CLE2	$e^+e^- \approx \Upsilon(4S)$
0.35 ± 0.20	[2,3] ALBRECHT	91G	ARG	$e^+e^- \approx 10.4$ GeV

[1] BERGFELD 94 measures $\sigma(e^+e^- \rightarrow \Lambda_c^+ X)\cdot B(\Lambda_c^+ \rightarrow \Lambda \mu^+ \nu_\mu) = (4.43 \pm 0.51 \pm 0.64)$ pb.

[2] To extract $\Gamma(\Lambda_c^+ \rightarrow \Lambda \mu^+ \nu_\mu)/\Gamma(\Lambda_c^+ \rightarrow pK^-\pi^+)$, we use $\sigma(e^+e^- \rightarrow \Lambda_c^+ X)\cdot B(\Lambda_c \rightarrow pK^-\pi^+) = (11.2 \pm 1.3)$ pb, which is the weighted average of measurements from ARGUS (ALBRECHT 96E) and CLEO (AVERY 91).

[3] ALBRECHT 91G measures $\sigma(e^+e^- \rightarrow \Lambda_c^+ X)\cdot B(\Lambda_c^+ \rightarrow \Lambda \mu^+ \nu_\mu) = (3.91 \pm 2.02 \pm 0.90)$ pb.

Inclusive modes

$\Gamma(e^+\text{anything})/\Gamma_{\text{total}}$ — Γ_{66}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.045±0.017	VELLA	82	MRK2	e^+e^- 4.5–6.8 GeV

$\Gamma(pe^+\text{anything})/\Gamma_{\text{total}}$ — Γ_{67}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.018±0.009	[1] VELLA	82	MRK2	e^+e^- 4.5–6.8 GeV

[1] VELLA 82 includes protons from Λ decay.

$\Gamma(\Lambda e^+\text{anything})/\Gamma_{\text{total}}$ — Γ_{68}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.011 ± 0.008	[1] VELLA	82	MRK2	e^+e^- 4.5–6.8 GeV

[1] VELLA 82 includes Λ's from Σ^0 decay.

$\Gamma(p\text{ anything})/\Gamma_{\text{total}}$ — Γ_{69}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.50±0.08±0.14	[1] CRAWFORD	92	CLEO	e^+e^- 10.5 GeV

[1] This CRAWFORD 92 value includes protons from Λ decay. The value is model dependent, but account is taken of this in the systematic error.

$\Gamma(p\text{ anything (no }\Lambda))/\Gamma_{\text{total}}$ — Γ_{70}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.12±0.10±0.16	CRAWFORD	92	CLEO	e^+e^- 10.5 GeV

$\Gamma(n \text{ anything})/\Gamma_{total}$ — Γ_{72}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.50±0.08±0.14	[1] CRAWFORD 92	CLEO	e^+e^- 10.5 GeV

[1] This CRAWFORD 92 value includes neutrons from Λ decay. The value is model dependent, but account is taken of this in the systematic error.

$\Gamma(n \text{ anything (no } \Lambda))/\Gamma_{total}$ — Γ_{73}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.29±0.09±0.15	CRAWFORD 92	CLEO	e^+e^- 10.5 GeV

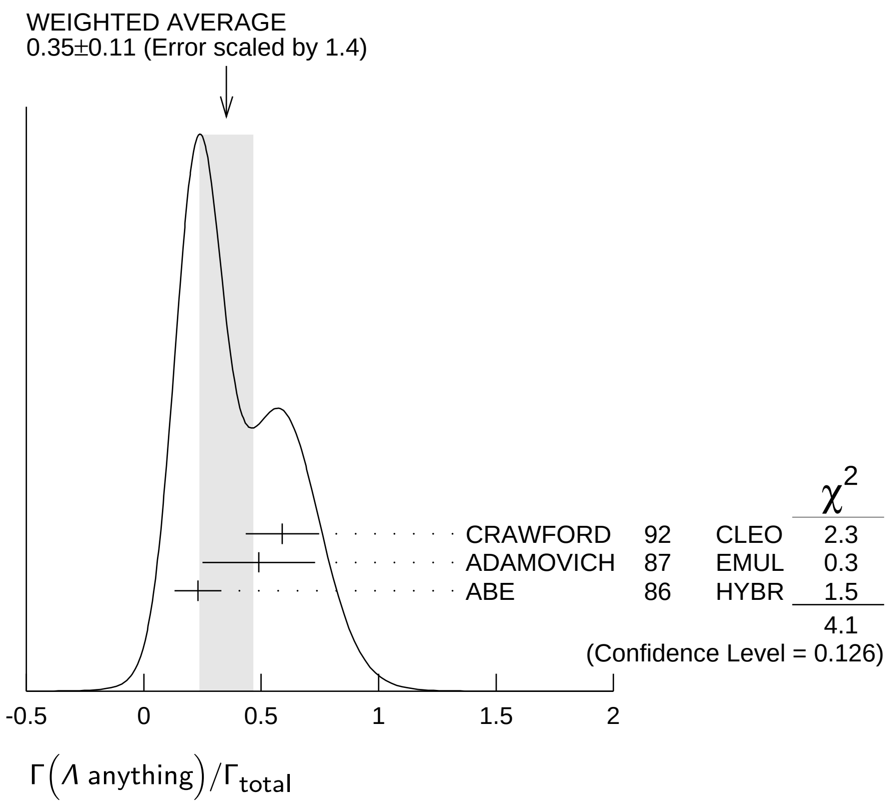
$\Gamma(p \text{ hadrons})/\Gamma_{total}$ — Γ_{71}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.41±0.24	ADAMOVICH 87	EMUL	γA 20–70 GeV/c

$\Gamma(\Lambda \text{ anything})/\Gamma_{total}$ — Γ_{74}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.35±0.11 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.			
0.59±0.10±0.12		CRAWFORD 92	CLEO	e^+e^- 10.5 GeV
0.49±0.24		ADAMOVICH 87	EMUL	γA 20–70 GeV/c
0.23±0.10	8	[1] ABE 86	HYBR	20 GeV γp

[1] ABE 86 includes Λ's from Σ^0 decay.



$\Gamma(\Sigma^{\pm}\text{anything})/\Gamma_{\text{total}}$ — Γ_{75}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.1±0.05	5	ABE	86	HYBR	20 GeV γp

$\Gamma(3\text{prongs})/\Gamma_{\text{total}}$ — Γ_{76}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.24±0.07±0.04	KAYIS-TOPAK...	03	CHRS	ν_μ emulsion, $\overline{E}$=27 GeV

Rare or forbidden modes

$\Gamma(p e^+ e^-)/\Gamma_{\text{total}}$ — Γ_{77}/Γ

A test for the ΔC=1 weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<5.5 \times 10^{-6}$	90	4.0 ± 7.1	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(p \mu^+ \mu^-)/\Gamma_{\text{total}}$ — Γ_{78}/Γ

A test for the ΔC=1 weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<44 \times 10^{-6}$	90	11.1 ± 5.6	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$< 3.4 \times 10^{-4}$	90	0	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(p e^+ \mu^-)/\Gamma_{\text{total}}$ — Γ_{79}/Γ

A test of lepton family-number conservation.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<9.9 \times 10^{-6}$	90	-0.7 ± 3.0	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(p e^- \mu^+)/\Gamma_{\text{total}}$ — Γ_{80}/Γ

A test of lepton family-number conservation.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<19 \times 10^{-6}$	90	6.2 ± 4.9	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\overline{p} 2e^+)/\Gamma_{\text{total}}$ — Γ_{81}/Γ

A test of lepton- and baryon-number conservation.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<2.7 \times 10^{-6}$	90	-1.5 ± 4.5	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\overline{p} 2\mu^+)/\Gamma_{\text{total}}$ — Γ_{82}/Γ

A test of lepton- and baryon-number conservation and of lepton family-number conservation.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<9.4 \times 10^{-6}$	90	0.0 ± 2.2	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\overline{p} e^+ \mu^+)/\Gamma_{\text{total}}$ — Γ_{83}/Γ

A test of lepton- and baryon-number conservation and of lepton family-number conservation.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<16 \times 10^{-6}$	90	10.1 ± 6.8	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^- \mu^+ \mu^+)/\Gamma_{total}$ Γ_{84}/Γ

A test of lepton-number conservation.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<7.0 × 10^{-4}	90	0	KODAMA	95	E653	π^- emulsion 600 GeV

Λ_c^+ DECAY PARAMETERS

See the note on "Baryon Decay Parameters" in the neutron Listings.

α FOR $\Lambda_c^+ \rightarrow \Lambda\pi^+$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.91±0.15 OUR AVERAGE					
−0.78±0.16±0.19		LINK	06A	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV
−0.94±0.21±0.12	414	[1] BISHAI	95	CLE2	$e^+ e^- \approx \Upsilon(4S)$
−0.96±0.42		ALBRECHT	92	ARG	$e^+ e^- \approx$ 10.4 GeV
−1.1 ±0.4	86	AVERY	90B	CLEO	$e^+ e^- \approx$ 10.6 GeV

[1] BISHAI 95 actually gives $\alpha = -0.94^{+0.21}_{-0.06}{}^{+0.12}_{-0.06}$, chopping the errors at the physical limit −1.0. However, for $\alpha \approx -1.0$, some experiments should *get* unphysical values ($\alpha < -1.0$), and for averaging with other measurements such values (or errors that extend below −1.0) should *not* be chopped.

α FOR $\Lambda_c^+ \rightarrow \Sigma^+\pi^0$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.45±0.31±0.06	89	BISHAI	95	CLE2	$e^+ e^- \approx \Upsilon(4S)$

α FOR $\Lambda_c^+ \rightarrow \Lambda\ell^+\nu_\ell$

The experiments don't cover the complete (or same incomplete) $M(\Lambda\ell^+)$ range, but we average them together anyway.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.86±0.04 OUR AVERAGE					
−0.86±0.03±0.02	3201	[1] HINSON	05	CLEO	$e^+ e^- \approx \Upsilon(4S)$
−0.91±0.42±0.25		[2] ALBRECHT	94B	ARG	$e^+ e^- \approx$ 10 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$-0.82^{+0.09}_{-0.06}{}^{+0.06}_{-0.03}$	700	[3] CRAWFORD	95	CLE2	See HINSON 05
$-0.89^{+0.17}_{-0.11}{}^{+0.09}_{-0.05}$	350	[4] BERGFELD	94	CLE2	See CRAWFORD 95

[1] HINSON 05 measures the form-factor ratio $R \equiv f_2/f_1$ for $\Lambda_c^+ \rightarrow \Lambda e^+ \nu_e$ events to be −0.31 ± 0.05 ± 0.04 and the pole mass to be 2.21 ± 0.08 ± 0.14 GeV/c^2, and from these calculates α, averaged over q^2, where $\langle q^2 \rangle = 0.67\ (\text{GeV/c})^2$.

[2] ALBRECHT 94B uses Λe^+ and $\Lambda \mu^+$ events in the mass range 1.85 $< M(\Lambda\ell^+) <$ 2.20 GeV.

[3] CRAWFORD 95 measures the form-factor ratio $R \equiv f_2/f_1$ for $\Lambda_c^+ \rightarrow \Lambda e^+ \nu_e$ events to be −0.25 ± 0.14 ± 0.08 and from this calculates α, averaged over q^2, to be the above.

[4] BERGFELD 94 uses Λe^+ events.

Λ_c^+, $\overline{\Lambda}_c^-$ *CP*-VIOLATING DECAY ASYMMETRIES

$(\alpha+\overline{\alpha})/(\alpha-\overline{\alpha})$ in $\Lambda_c^+ \to \Lambda\pi^+$, $\overline{\Lambda}_c^- \to \overline{\Lambda}\pi^-$

This is zero if *CP* is conserved.

VALUE	DOCUMENT ID		TECN	COMMENT
−0.07±0.19±0.24	LINK	06A	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$(\alpha+\overline{\alpha})/(\alpha-\overline{\alpha})$ in $\Lambda_c^+ \to \Lambda e^+\nu_e$, $\overline{\Lambda}_c^- \to \overline{\Lambda} e^-\overline{\nu}_e$

This is zero if *CP* is conserved.

VALUE	DOCUMENT ID		TECN	COMMENT
0.00±0.03±0.02	HINSON	05	CLEO	$e^+e^- \approx \Upsilon(4S)$

Λ_c^+ REFERENCES

We have omitted some papers that have been superseded by later experiments. The omitted papers may be found in our 1992 edition (Physical Review **D45**, 1 June, Part II) or in earlier editions.

ABLIKIM	16	PRL 116 052001	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	16U	PRL 117 232002	M. Ablikim *et al.*	(BES III Collab.)
YANG	16	PRL 117 011801	S.B. Yang *et al.*	(BELLE Collab.)
ABLIKIM	15Y	PRL 115 221805	M. Ablikim *et al.*	(BES III Collab.)
ZUPANC	14	PRL 113 042002	A. Zupanc *et al.*	(BELLE Collab.)
LEES	11G	PR D84 072006	J.P. Lees *et al.*	(BABAR Collab.)
VAZQUEZ-JA...	08	PL B666 299	E. Vazquez-Jauregui *et al.*	(SELEX Collab.)
AUBERT	07U	PR D75 052002	B. Aubert *et al.*	(BABAR Collab.)
LINK	06A	PL B634 165	J.M. Link *et al.*	(FNAL FOCUS Collab.)
AUBERT,B	05S	PR D72 052006	B. Aubert *et al.*	(BABAR Collab.)
HINSON	05	PRL 94 191801	J.W. Hinson *et al.*	(CLEO Collab.)
LINK	05F	PL B624 22	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	05K	PL B624 166	J.M. Link *et al.*	(FNAL FOCUS Collab.)
CRONIN-HEN...	03	PR D67 012001	D. Cronin-Hennessy *et al.*	(CLEO Collab.)
KAYIS-TOPAK...	03	PL B555 156	A. Kayis-Topaksu *et al.*	(CERN CHORUS Collab.)
ABE	02C	PL B524 33	K. Abe *et al.*	(KEK BELLE Collab.)
LINK	02C	PRL 88 161801	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	02G	PL B540 25	J.M. Link *et al.*	(FNAL FOCUS Collab.)
PDG	02	PR D66 010001	K. Hagiwara *et al.*	(PDG Collab.)
KUSHNIR...	01	PRL 86 5243	A. Kushnirenko *et al.*	(FNAL SELEX Collab.)
MAHMOOD	01	PRL 86 2232	A.H. Mahmood *et al.*	(CLEO Collab.)
AITALA	00	PL B471 449	E.M. Aitala *et al.*	(FNAL E791 Collab.)
ALAM	98	PR D57 4467	M.S. Alam *et al.*	(CLEO Collab.)
ALBRECHT	96E	PRPL 276 223	H. Albrecht *et al.*	(ARGUS Collab.)
ALEXANDER	96C	PR D53 R1013	J.P. Alexander *et al.*	(CLEO Collab.)
ALBRECHT	95B	PL B342 397	H. Albrecht *et al.*	(ARGUS Collab.)
AMMAR	95	PRL 74 3534	R. Ammar *et al.*	(CLEO Collab.)
BISHAI	95	PL B350 256	M. Bishai *et al.*	(CLEO Collab.)
CRAWFORD	95	PRL 75 624	G. Crawford *et al.*	(CLEO Collab.)
KODAMA	95	PL B345 85	K. Kodama *et al.*	(FNAL E653 Collab.)
ALBRECHT	94B	PL B326 320	H. Albrecht *et al.*	(ARGUS Collab.)
ALEEV	94	PAN 57 1370	A.N. Aleev *et al.*	(Serpukhov BIS-2 Collab.)
		Translated from YF 57 1443.		
AVERY	94	PL B325 257	P. Avery *et al.*	(CLEO Collab.)
BERGFELD	94	PL B323 219	T. Bergfeld *et al.*	(CLEO Collab.)
FRABETTI	94E	PL B328 193	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
AVERY	93	PRL 71 2391	P. Avery *et al.*	(CLEO Collab.)
BOZEK	93	PL B312 247	A. Bozek *et al.*	(CERN NA32 Collab.)
FRABETTI	93D	PRL 70 1755	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
FRABETTI	93H	PL B314 477	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
KUBOTA	93	PRL 71 3255	Y. Kubota *et al.*	(CLEO Collab.)
ALBRECHT	92	PL B274 239	H. Albrecht *et al.*	(ARGUS Collab.)
BARLAG	92	PL B283 465	S. Barlag *et al.*	(ACCMOR Collab.)
CRAWFORD	92	PR D45 752	G. Crawford *et al.*	(CLEO Collab.)

JEZABEK	92	PL B286 175	M. Jezabek, K. Rybicki, R. Rylko	(CRAC)
ALBRECHT	91G	PL B269 234	H. Albrecht *et al.*	(ARGUS Collab.)
AVERY	91	PR D43 3599	P. Avery *et al.*	(CLEO Collab.)
ALVAREZ	90	ZPHY C47 539	M.P. Alvarez *et al.*	(CERN NA14/2 Collab.)
ALVAREZ	90B	PL B246 256	M.P. Alvarez *et al.*	(CERN NA14/2 Collab.)
ANJOS	90	PR D41 801	J.C. Anjos *et al.*	(FNAL E691 Collab.)
AVERY	90B	PRL 65 2842	P. Avery *et al.*	(CLEO Collab.)
BARLAG	90D	ZPHY C48 29	S. Barlag *et al.*	(ACCMOR Collab.)
FRABETTI	90	PL B251 639	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
BARLAG	89	PL B218 374	S. Barlag *et al.*	(ACCMOR Collab.)
AGUILAR-...	88B	ZPHY C40 321	M. Aguilar-Benitez *et al.*	(LEBC-EHS Collab.)
Also		PL B189 254	M. Aguilar-Benitez *et al.*	(LEBC-EHS Collab.)
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Also		SJNP 48 833	M. Begalli *et al.*	(LEBC-EHS Collab.)
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ALBRECHT	88C	PL B207 109	H. Albrecht *et al.*	(ARGUS Collab.)
ANJOS	88B	PRL 60 1379	J.C. Anjos *et al.*	(FNAL E691 Collab.)
ADAMOVICH	87	EPL 4 887	M.I. Adamovich *et al.*	(Photon Emulsion Collab.)
Also		SJNP 46 447	F. Viaggi *et al.*	(Photon Emulsion Collab.)
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AMENDOLIA	87	ZPHY C36 513	S.R. Amendolia *et al.*	(CERN NA1 Collab.)
JONES	87	ZPHY C36 593	G.T. Jones *et al.*	(CERN WA21 Collab.)
ABE	86	PR D33 1	K. Abe *et al.*	(SLAC HF Photon Collab.)
BOSETTI	82	PL 109B 234	P.C. Bosetti *et al.*	(AACH3, BONN, CERN+)
VELLA	82	PRL 48 1515	E. Vella *et al.*	(SLAC, LBL, UCB)
BASILE	81B	NC 62A 14	M. Basile *et al.*	(CERN, BGNA, PGIA, FRAS)
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