Ξ_c^+

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

According to the quark model, the Ξ_c^+ (quark content usc) and Ξ_c^0 form an isospin doublet, and the spin-parity ought to be $J^P = 1/2^+$. None of I, J, or P has actually been measured.

Ξ_c^+ MASS

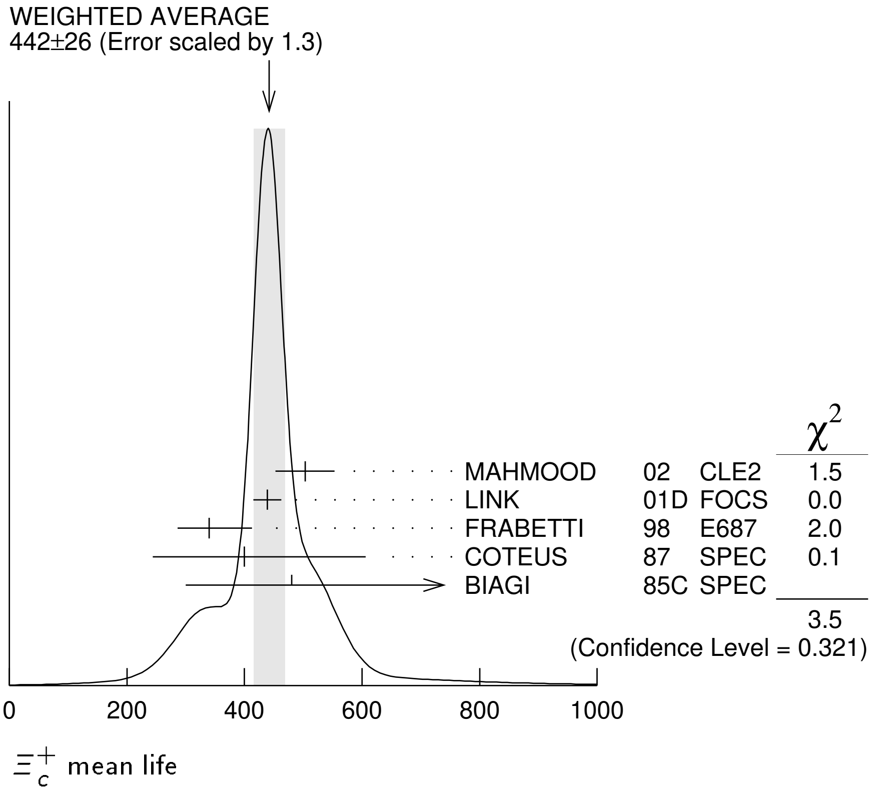
The fit uses the Ξ_c^+ and Ξ_c^0 mass and mass-difference measurements.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2466.3± 1.4 OUR FIT					
2466.4± 1.5 OUR AVERAGE					
2465.8± 1.9± 2.5	90	FRABETTI	98	E687	γ Be, $\overline{E}_\gamma$= 220 GeV
2467.0± 1.6± 2.0	147	EDWARDS	96	CLE2	$e^+e^- \approx \Upsilon(4S)$
2465.1± 3.6± 1.9	30	ALBRECHT	90F	ARG	e^+e^- at $\Upsilon(4S)$
2467 ± 3 ± 4	23	ALAM	89	CLEO	e^+e^- 10.6 GeV
2466.5± 2.7± 1.2	5	BARLAG	89C	ACCM	π^- Cu 230 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2464.4± 2.0± 1.4	30	FRABETTI	93B	E687	See FRABETTI 98
2459 ± 5 ±30	56	[1] COTEUS	87	SPEC	nA $\simeq$ 600 GeV
2460 ±25	82	BIAGI	83	SPEC	Σ^- Be 135 GeV

[1] Although COTEUS 87 claims to agree well with BIAGI 83 on the mass and width, there appears to be a discrepancy between the two experiments. BIAGI 83 sees a single peak (stated significance about 6 standard deviations) in the $\Lambda K^- \pi^+ \pi^+$ mass spectrum. COTEUS 87 sees *two* peaks in the same spectrum, one at the Ξ_c^+ mass, the other 75 MeV lower. The latter is attributed to $\Xi_c^+ \rightarrow \Sigma^0 K^- \pi^+ \pi^+ \rightarrow (\Lambda\gamma) K^- \pi^+ \pi^+$, with the γ unseen. The *combined* significance of the double peak is stated to be 5.5 standard deviations. But the absence of any trace of a lower peak in BIAGI 83 seems to us to throw into question the interpretation of the lower peak of COTEUS 87.

Ξ_c^+ MEAN LIFE

VALUE (10^{-15} s)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
442± 26 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
503± 47± 18	250	MAHMOOD	02	CLE2	$e^+e^- \approx \Upsilon(4S)$
439± 22± 9	532	LINK	01D	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
$340^{+\ 70}_{-\ 50}\pm$ 20	56	FRABETTI	98	E687	γ Be, $\overline{E}_\gamma$= 220 GeV
$400^{+180}_{-120}\pm100$	102	COTEUS	87	SPEC	nA $\simeq$ 600 GeV
$480^{+210}_{-150}{}^{+200}_{-100}$	53	BIAGI	85C	SPEC	Σ^- Be 135 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$410^{+110}_{-\ 80}\pm$ 20	30	FRABETTI	93B	E687	See FRABETTI 98
$200^{+110}_{-\ 60}$	6	BARLAG	89C	ACCM	π^- (K^-) Cu 230 GeV



Ξ_c^+ DECAY MODES

	Mode		Fraction (Γ_i/Γ)	Confidence level

No absolute branching fractions have been measured.
The following are branching *ratios* relative to $\Xi^- \pi^+ \pi^+$.

Cabibbo-favored ($S = -2$) decays

	Mode		Fraction (Γ_i/Γ)	Confidence level
Γ_1	$\Lambda \overline{K}{}^0 \pi^+$		—	
Γ_2	$\quad\Sigma(1385)^+ \overline{K}{}^0$	[a,b]	1.0 ± 0.5	
Γ_3	$\Lambda K^- \pi^+ \pi^+$	[a]	0.34 ± 0.12	
Γ_4	$\quad\Lambda \overline{K}{}^*(892)^0 \pi^+$	[a,b]	<0.2	90%
Γ_5	$\quad\Sigma(1385)^+ K^- \pi^+$	[a,b]	<0.3	90%
Γ_6	$\Sigma^+ K^- \pi^+$	[a]	0.94 ± 0.11	
Γ_7	$\quad\Sigma^+ \overline{K}{}^*(892)^0$	[a,b]	0.81 ± 0.15	
Γ_8	$\Sigma^0 K^- \pi^+ \pi^+$	[a]	0.29 ± 0.16	
Γ_9	$\Xi^0 \pi^+$	[a]	0.55 ± 0.16	
Γ_{10}	$\Xi^- \pi^+ \pi^+$	[a]	DEFINED AS 1	
Γ_{11}	$\quad\Xi(1530)^0 \pi^+$	[a,b]	<0.1	90%
Γ_{12}	$\Xi^0 \pi^+ \pi^0$	[a]	2.34 ± 0.68	
Γ_{13}	$\Xi^0 \pi^+ \pi^+ \pi^-$	[a]	1.74 ± 0.50	
Γ_{14}	$\Xi^0 e^+ \nu_e$	[a]	$2.3 \ ^{+0.7}_{-0.9}$	
Γ_{15}	$\Omega^- K^+ \pi^+$	[a]	0.07 ± 0.04	

Cabibbo-suppressed decays

Γ_{16}	$pK^-\pi^+$	[a]	0.21 ± 0.03	
Γ_{17}	$p\overline{K}^*(892)^0$	[a,b]	0.12 ± 0.02	
Γ_{18}	$\Sigma^+K^+K^-$	[a]	0.15 ± 0.07	
Γ_{19}	$\Sigma^+\phi$	[a,b]	<0.11	90%
Γ_{20}	$\Xi(1690)^0K^+$ $\times B(\Xi(1690)^0\to\Sigma^+K^-)$	[a]	<0.05	90%

[a] No absolute branching fractions have been measured. The following are branching *ratios* relative to $\Xi^-\pi^+\pi^+$.

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

Ξ_c^+ BRANCHING RATIOS

Cabibbo-favored ($S=-2$) decays

$\Gamma(\Sigma(1385)^+\overline{K}^0)/\Gamma(\Xi^-\pi^+\pi^+)$ — Γ_2/Γ_{10}

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

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.00±0.49±0.24	20	LINK	03E	FOCS	< 1.72, 90% CL

$\Gamma(\Lambda K^-\pi^+\pi^+)/\Gamma_{total}$ — Γ_3/Γ

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	56	COTEUS	87	SPEC	$nA\simeq$ 600 GeV
seen	82	[2] BIAGI	83	SPEC	Σ^- Be 135 GeV

[2] BIAGI 85B looks for but does not see the Ξ_c^+ in $pK^-\overline{K}^0\pi^+$ ($\Gamma(pK^-\overline{K}^0\pi^+)$ / $\Gamma(\Lambda K^-\pi^+\pi^+)<0.08$ with 90% CL), $p2K^-2\pi^+$ ($\Gamma(p2K^-2\pi^+)$ / $\Gamma(\Lambda K^-\pi^+\pi^+)$ <0.03, 90% CL), $\Omega^-K^+\pi^+$, $\Lambda K^{*0}\pi^+$, and $\Sigma(1385)^+K^-\pi^+$.

$\Gamma(\Lambda K^-\pi^+\pi^+)/\Gamma(\Xi^-\pi^+\pi^+)$ — Γ_3/Γ_{10}

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.34±0.12 OUR AVERAGE	Error includes scale factor of 1.5.				
0.28±0.06±0.06	58	LINK	03E	FOCS	γ nucleus, $\overline{E}_\gamma\approx$ 180 GeV
0.58±0.16±0.07	61	BERGFELD	96	CLE2	$e^+e^-\approx\Upsilon(4S)$

$\Gamma(\Lambda\overline{K}^*(892)^0\pi^+)/\Gamma(\Lambda K^-\pi^+\pi^+)$ — Γ_4/Γ_3

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

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.5	90	BERGFELD	96	CLE2	$e^+e^-\approx\Upsilon(4S)$

$\Gamma(\Sigma(1385)^+K^-\pi^+)/\Gamma(\Lambda K^-\pi^+\pi^+)$ — Γ_5/Γ_3

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

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.7	90	BERGFELD	96	CLE2	$e^+e^-\approx\Upsilon(4S)$

$\Gamma(\Sigma^+ K^- \pi^+)/\Gamma(\Xi^- \pi^+ \pi^+)$ — Γ_6/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.94±0.11 OUR AVERAGE					
0.91±0.11±0.04	251	LINK	03E	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
1.18±0.26±0.17	119	BERGFELD	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.92±0.20±0.07		[3] JUN	00	SELX	Σ^- nucleus, 600 GeV

[3] This JUN 00 result is redundant with other results given below.

$\Gamma(\Sigma^+ \overline{K}^*(892)^0)/\Gamma(\Xi^- \pi^+ \pi^+)$ — Γ_7/Γ_{10}

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.81±0.15 OUR AVERAGE					
0.78±0.16±0.06	119	LINK	03E	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
0.92±0.27±0.14	61	BERGFELD	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	59	AVERY	95	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^0 K^- \pi^+ \pi^+)/\Gamma(\Lambda K^- \pi^+ \pi^+)$ — Γ_8/Γ_3

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.84±0.36	47	[4] COTEUS	87	SPEC	$nA \simeq$ 600 GeV

[4] See, however, the note on the COTEUS 87 Ξ_c^+ mass measurement.

$\Gamma(\Xi^0 \pi^+)/\Gamma(\Xi^- \pi^+ \pi^+)$ — Γ_9/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.55±0.13±0.09	39	EDWARDS	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	131	BERGFELD	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$
seen	160	AVERY	95	CLE2	$e^+ e^- \approx \Upsilon(4S)$
seen	30	FRABETTI	93B	E687	γBe, $\overline{E}_\gamma$= 220 GeV
seen	30	ALBRECHT	90F	ARG	$e^+ e^-$ at $\Upsilon(4S)$
seen	23	ALAM	89	CLEO	$e^+ e^-$ 10.6 GeV

$\Gamma(\Xi(1530)^0 \pi^+)/\Gamma(\Xi^- \pi^+ \pi^+)$ — Γ_{11}/Γ_{10}

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.1	90	LINK	03E	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.2	90	BERGFELD	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Xi^0 \pi^+ \pi^0)/\Gamma(\Xi^- \pi^+ \pi^+)$ — Γ_{12}/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
2.34±0.57±0.37	81	EDWARDS	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Xi(1530)^0\pi^+)/\Gamma(\Xi^0\pi^+\pi^0)$ — Γ_{11}/Γ_{12}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.3	90	EDWARDS	96	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi^0\pi^+\pi^+\pi^-)/\Gamma(\Xi^-\pi^+\pi^+)$ — Γ_{13}/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.74±0.42±0.27	57	EDWARDS	96	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi^0 e^+\nu_e)/\Gamma(\Xi^-\pi^+\pi^+)$ — Γ_{14}/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{2.3\pm0.6^{+0.3}_{-0.6}}$	41	ALEXANDER	95B	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Omega^- K^+\pi^+)/\Gamma(\Xi^-\pi^+\pi^+)$ — Γ_{15}/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.07±0.03±0.03	14	LINK	03E	FOCS	<0.12, 90% CL

Cabibbo-suppressed decays

$\Gamma(pK^-\pi^+)/\Gamma(\Sigma^+K^-\pi^+)$ — Γ_{16}/Γ_6

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.22±0.06±0.03	76	JUN	00	SELX	Σ^- nucleus, 600 GeV

$\Gamma(pK^-\pi^+)/\Gamma(\Xi^-\pi^+\pi^+)$ — Γ_{16}/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.214±0.034 OUR AVERAGE					
0.234±0.047±0.022	202	LINK	01B	FOCS	γ nucleus
0.20 ±0.04 ±0.02	76	JUN	00	SELX	Σ^- nucleus, 600 GeV

$\Gamma(p\overline{K}^*(892)^0)/\Gamma(pK^-\pi^+)$ — Γ_{17}/Γ_{16}

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.54±0.09±0.05	LINK	01B	FOCS	γ nucleus

$\Gamma(\Sigma^+K^+K^-)/\Gamma(\Sigma^+K^-\pi^+)$ — Γ_{18}/Γ_6

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.16±0.06±0.01	17	LINK	03E	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(\Sigma^+\phi)/\Gamma(\Sigma^+K^-\pi^+)$ — Γ_{19}/Γ_6

Unseen decay modes of the ϕ are included.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.12	90	LINK	03E	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(\Xi(1690)^0K^+\times B(\Xi(1690)^0 \to \Sigma^+K^-))/\Gamma(\Sigma^+K^-\pi^+)$ — Γ_{20}/Γ_6

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.05	90	LINK	03E	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

Ξ_c^+ REFERENCES

LINK	03E	PL B571 139	J.M. Link *et al.*	(FNAL FOCUS Collab.)
MAHMOOD	02	PR D65 031102	A.H. Mahmood *et al.*	(CLEO Collab.)
LINK	01B	PL B512 277	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	01D	PL B523 53	J.M. Link *et al.*	(FNAL FOCUS Collab.)
JUN	00	PRL 84 1857	S.Y. Jun *et al.*	(FNAL SELEX Collab.)
FRABETTI	98	PL B427 211	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
BERGFELD	96	PL B365 431	T. Bergfeld *et al.*	(CLEO Collab.)
EDWARDS	96	PL B373 261	K.W. Edwards *et al.*	(CLEO Collab.)
ALEXANDER	95B	PRL 74 3113	J. Alexander *et al.*	(CLEO Collab.)
Also	95E	PRL 75 4155 (erratum)	J. Alexander *et al.*	(CLEO Collab.)
AVERY	95	PRL 75 4364	P. Avery *et al.*	(CLEO Collab.)
FRABETTI	93B	PRL 70 1381	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
ALBRECHT	90F	PL B247 121	H. Albrecht *et al.*	(ARGUS Collab.)
ALAM	89	PL B226 401	M.S. Alam *et al.*	(CLEO Collab.)
BARLAG	89C	PL B233 522	S. Barlag *et al.*	(ACCMOR Collab.)
COTEUS	87	PRL 59 1530	P. Coteus *et al.*	(FNAL E400 Collab.)
BIAGI	85B	ZPHY C28 175	S.F. Biagi *et al.*	(CERN WA62 Collab.)
BIAGI	85C	PL 150B 230	S.F. Biagi *et al.*	(CERN WA62 Collab.)
BIAGI	83	PL 122B 455	S.F. Biagi *et al.*	(CERN WA62 Collab.)