$\Xi_c(2970)$

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

was $\Xi_c(2980)$

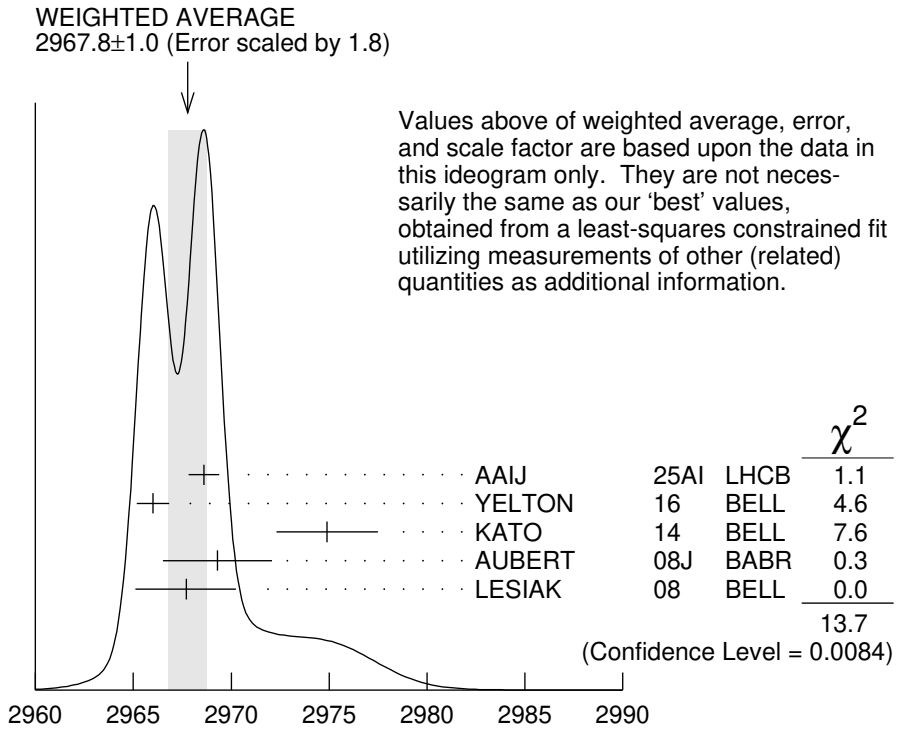
$J^P = 1/2^+$ is favored by MOON 21.

$\Xi_c(2970)$ MASSES

$\Xi_c(2970)^+$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2965.2±1.0 OUR FIT Error includes scale factor of 2.9.					
2967.8±1.0 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.					
2968.6±0.5±0.6	6.1k	[1] AAIJ	25AI	LHCB	pp at 13 TeV
2966.0±0.8±0.2	0.9k	YELTON	16	BELL	$e^+e^- \to \Upsilon(4S), \Upsilon(5S)$ and continuum
2974.9±1.5±2.1	244 ± 39	KATO	14	BELL	e^+e^- $\Upsilon(1S)$ to $\Upsilon(5S)$
2969.3±2.2±1.7	756 ± 206	AUBERT	08J	BABR	$e^+e^- \approx$ 10.58 GeV
$2967.7 \pm 2.3^{+1.1}_{-1.2}$	78 ± 13	LESIAK	08	BELL	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2978.5±2.1±2.0	405 ± 51	CHISTOV	06	BELL	See KATO 14

[1] AAIJ 25AI reports 2968.6 ± 0.5 ± 0.5 ± 0.2 MeV value where the third uncertainty is due to the Ξ_c^+ mass.



$\Xi_c(2970)^0$ MASS

The evidence is statistically weaker for this charge state.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2967.3 ±1.9 OUR FIT	Error includes scale factor of 7.2.				
2965.9 ±2.2 OUR AVERAGE	Error includes scale factor of 7.4.				
2964.88±0.26±0.20	11.7k	[1] AAIJ	20X	LHCB	pp at 13 TeV
2970.8 ±0.7 ±0.2	1.4k	YELTON	16	BELL	$e^+e^- \to \Upsilon(4S)$, $\Upsilon(5S)$, continuum
2972.9 ±4.4 ±1.6	67 ± 44	AUBERT	08J	BABR	$e^+e^- \approx$ 10.58 GeV
2965.7 ±2.4 $^{+1.1}_{-1.2}$	57 ± 13	LESIAK	08	BELL	$e^+e^- \approx \Upsilon(4S)$
2977.1 ±8.8 ±3.5	42 ± 24	CHISTOV	06	BELL	$e^+e^- \approx \Upsilon(4S)$

[1] AAIJ 20X reports 2964.88 ± 0.26 ± 0.14 ± 0.14 MeV where the last uncertainty is due to the Λ_c^+ mass. Further studies are required to establish whether the narrow resonance at 2965 MeV is a different baryon from the narrow resonance at 2970 MeV seen by YELTON 16.

$\Xi_c(2970) - \Xi_c$ MASS DIFFERENCES

$m_{\Xi_c(2970)^+} - m_{\Xi_c^+}$

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
497.4±1.0 OUR FIT	Error includes scale factor of 2.7.				
498.1±0.8±0.2	916	YELTON	16	BELL	e^+e^-, Υ regions

$m_{\Xi_c(2970)^0} - m_{\Xi_c^0}$

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
496.8±1.9 OUR FIT	Error includes scale factor of 5.8.				
499.9±0.7±0.2	1.4k	YELTON	16	BELL	e^+e^-, Υ regions

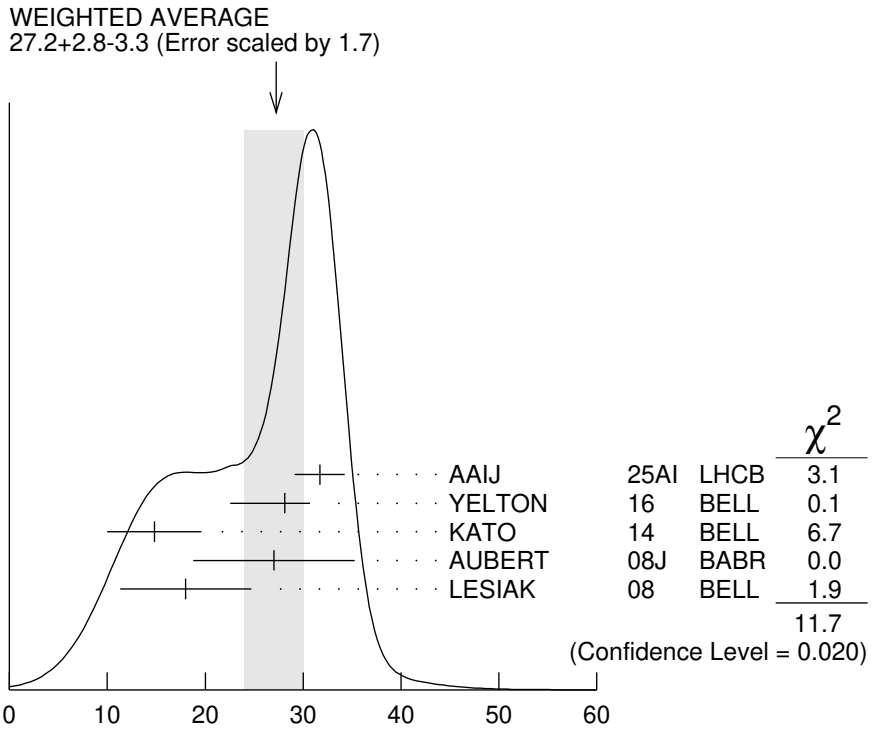
$\Xi_c(2970)^+ - \Xi_c(2970)^0$ MASS DIFFERENCE

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
−2.1±2.0 OUR FIT	Error includes scale factor of 5.4.			
−4.8±0.1±0.5	YELTON	16	BELL	916 and 1443 evts

$\Xi_c(2970)$ WIDTHS

$\Xi_c(2970)^+$ WIDTH

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$27.2^{+2.8}_{-3.3}$ OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.				
31.7±1.7±1.9	6.1k	AAIJ	25AI	LHCB	pp at 13 TeV
28.1±2.4$^{+1.0}_{-5.0}$	916	YELTON	16	BELL	e^+e^-, Υ regions
14.8±2.5±4.1	244 ± 39	KATO	14	BELL	e^+e^- $\Upsilon(1S)$ to $\Upsilon(5S)$
27 ±8 ±2	756 ± 206	AUBERT	08J	BABR	$e^+e^- \approx$ 10.58 GeV
18 ±6 ±3	78 ± 13	LESIAK	08	BELL	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
43.5±7.5±7.0	405 ± 51	CHISTOV	06	BELL	See KATO 14



$\Xi_c(2970)^0$ WIDTH

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$14.1 \pm 0.9 \pm 1.3$	11.7k	[1] AAIJ	20X	LHCB	pp at 13 TeV
$30.3 \pm 2.3^{+1.0}_{-1.8}$	1443	YELTON	16	BELL	e^+e^-, Υ regions

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

31	± 7	± 8	67 ± 44	AUBERT	08J	BABR $e^+e^- \approx$ 10.58 GeV
15	± 6	± 3	57 ± 13	LESIAK	08	BELL $e^+e^- \approx \Upsilon(4S)$

[1] Further studies are required to establish whether the narrow resonance at 2965 MeV is a different baryon from the narrow resonance at 2970 MeV seen by YELTON 16.

$\Xi_c(2970)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\Lambda_c^+ \overline{K} \pi$	seen
Γ_2	$\Sigma_c(2455) \overline{K}$	seen
Γ_3	$\Lambda_c^+ \overline{K}$	not seen
Γ_4	$\Lambda_c^+ K^-$	seen
Γ_5	$\Xi_c^+ \pi^+ \pi^-$	seen
Γ_6	$\Xi_c 2\pi$	seen
Γ_7	$\Xi_c' \pi$	seen
Γ_8	$\Xi_c(2645) \pi$	seen

$\Xi_c(2970)$ BRANCHING RATIOS

$\Gamma(\Lambda_c^+ \overline{K}\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	AUBERT	08J	BABR	$e^+e^- \approx \Upsilon(4S)$
seen	CHISTOV	06	BELL	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Lambda_c^+ K^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	11.7k	[1] AAIJ	20X	LHCB	pp at 13 TeV

[1] Further studies are required to establish whether the narrow resonance at 2965 MeV is a different baryon from the narrow resonance at 2970 MeV seen by YELTON 16.

$\Gamma(\Sigma_c(2455)\overline{K})/\Gamma(\Lambda_c^+ \overline{K}\pi)$ Γ_2/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.55±0.07±0.13	AUBERT	08J	BABR	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi_c^+ \pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	6.1k	AAIJ	25AI	LHCB	pp at 13 TeV

$\Gamma(\Xi_c' \pi)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	YELTON	16	BELL	e^+e^-, Υ regions

$\Gamma(\Xi_c(2645)\pi)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LESIAK	08	BELL	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi_c' \pi)/\Gamma(\Xi_c(2645)\pi)$ Γ_7/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{1.67\pm0.29^{+0.15}_{-0.09}\pm0.25}$	778	[1] MOON	21	BELL	e^+e^- at Υ(nS)

[1] Measurement of the ratio of $\Xi_c(2970)^+ \to \Xi_c(2645)^0\pi^+$ versus $\Xi_c(2970)^+ \to \Xi_c'^0\pi^+$. The last uncertainty is from possible isospin-symmetry-breaking effects. MOON 21 determines from an angular analysis of the $\Xi_c^+\pi^+\pi^-$ final state that the spin of the $\Xi_c(2970)^+$ is strongly compatible with $J = 1/2$, assuming domination by the lowest partial wave in $\Xi_c(2970)^+ \to \Xi_c(2645)^0\pi^+$. When further combined with the size of this ratio, MOON 21 determines from heavy quark symmetry that the spin-parity of the $\Xi_c(2970)^+$ is favored to be $J^P = 1/2^+$, with light degrees of freedom in the 0^+ state.

$\Xi_c(2970)$ REFERENCES

AAIJ	25AI	PRL 135 161901	R. Aaij *et al.*	(LHCb Collab.)
MOON	21	PR D103 L111101	T.J. Moon *et al.*	(BELLE Collab.) JP
AAIJ	20X	PRL 124 222001	R. Aaij *et al.*	(LHCb Collab.)
YELTON	16	PR D94 052011	J. Yelton *et al.*	(BELLE Collab.)
KATO	14	PR D89 052003	Y. Kato *et al.*	(BELLE Collab.)
AUBERT	08J	PR D77 012002	B. Aubert *et al.*	(BABAR Collab.)
LESIAK	08	PL B665 9	T. Lesiak *et al.*	(BELLE Collab.)
CHISTOV	06	PRL 97 162001	R. Chistov *et al.*	(BELLE Collab.)