

$\Xi_c(2970)$

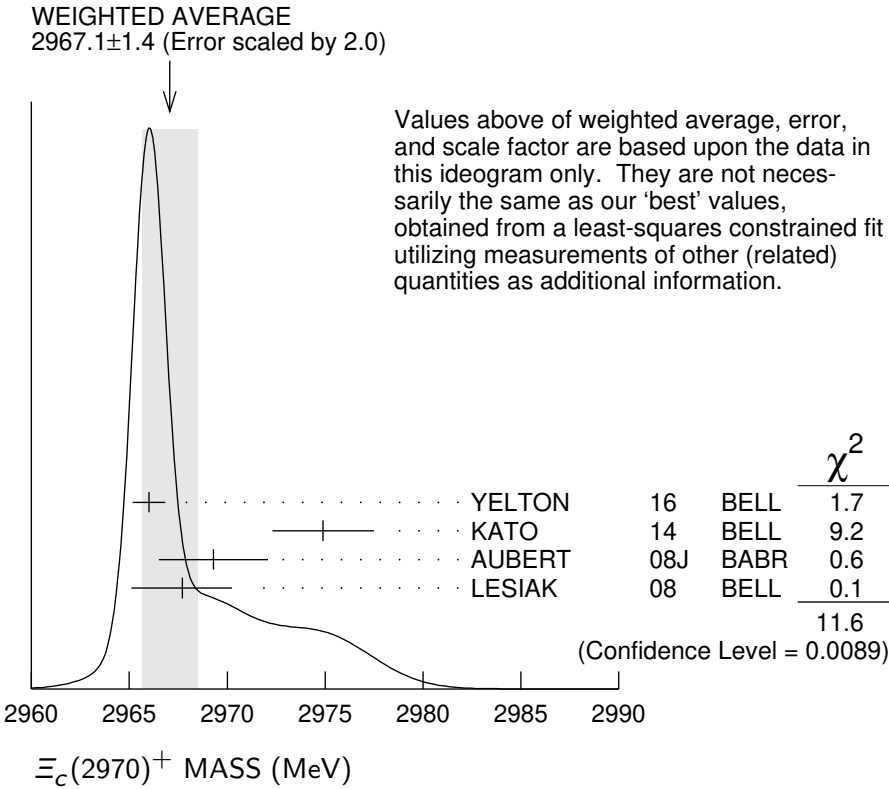
$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$ Status: ***

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
2964.3±1.5 OUR FIT	Error includes scale factor of 3.9.			
2967.1±1.4 OUR AVERAGE	Error includes scale factor of 2.0. See the ideogram below.			
2966.0±0.8±0.2	0.9k	YELTON	16 BELL	$e^+e^- \rightarrow \Upsilon(4S), \Upsilon(5S)$ 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±2.3 ^{+1.1} _{-1.2}	78 ± 13	LESIAC	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



$\Xi_c(2970)^0$ MASS

The evidence is statistically weaker for this charge state.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2967.1 ± 1.7 OUR FIT	Error includes scale factor of 6.7.			
2965.9 ± 2.2 OUR AVERAGE	Error includes scale factor of 7.4.			
2964.88 $\pm 0.26 \pm 0.20$	11.7k	¹ AAIJ	20X LHCb	pp at 13 TeV
2970.8 $\pm 0.7 \pm 0.2$	1.4k	YELTON	16 BELL	$e^+e^- \rightarrow \Upsilon(4S), \Upsilon(5S), \text{continuum}$
2972.9 $\pm 4.4 \pm 1.6$	67 $\pm$ 44	AUBERT	08J BABR	$e^+e^- \approx 10.58$ GeV
2965.7 $\pm 2.4 \begin{smallmatrix} +1.1 \\ -1.2 \end{smallmatrix}$	57 $\pm$ 13	LESLIAK	08 BELL	$e^+e^- \approx \Upsilon(4S)$
2977.1 $\pm 8.8 \pm 3.5$	42 $\pm$ 24	CHISTOV	06 BELL	$e^+e^- \approx \Upsilon(4S)$

¹ AAIJ 20X reports $2964.88 \pm 0.26 \pm 0.14 \pm 0.14$ 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
496.6 ± 1.5 OUR FIT	Error includes scale factor of 3.7.			
498.1 $\pm 0.8 \pm 0.2$	916	YELTON	16 BELL	e^+e^- , Υ regions

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
496.7 ± 1.8 OUR FIT	Error includes scale factor of 5.3.			
499.9 $\pm 0.7 \pm 0.2$	1.4k	YELTON	16 BELL	e^+e^- , Υ regions

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
-2.8 ± 1.9 OUR FIT	Error includes scale factor of 4.8.		
-4.8 $\pm 0.1 \pm 0.5$	YELTON	16 BELL	916 and 1443 evts

 $\Xi_c(2970)$ WIDTHS $\Xi_c(2970)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.9 $^{+2.4}_{-3.5}$ OUR AVERAGE	Error includes scale factor of 1.2.			
28.1 $\pm 2.4 \begin{smallmatrix} +1.0 \\ -5.0 \end{smallmatrix}$	916	YELTON	16 BELL	e^+e^- , Υ regions
14.8 $\pm 2.5 \pm 4.1$	244 $\pm$ 39	KATO	14 BELL	$e^+e^- \Upsilon(1S) \text{ to } \Upsilon(5S)$
27 $\pm 8 \pm 2$	756 $\pm$ 206	AUBERT	08J BABR	$e^+e^- \approx 10.58$ GeV
18 $\pm 6 \pm 3$	78 $\pm$ 13	LESLIAK	08 BELL	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
43.5 $\pm 7.5 \pm 7.0$	405 $\pm$ 51	CHISTOV	06 BELL	See KATO 14

$\Xi_c(2970)^0$ WIDTH

VALUE (MeV)	EPTS	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	LESIK	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)
$\Gamma_1 \Lambda_c^+ \bar{K} \pi$	seen
$\Gamma_2 \Sigma_c(2455) \bar{K}$	seen
$\Gamma_3 \Lambda_c^+ \bar{K}$	not seen
$\Gamma_4 \Lambda_c^+ K^-$	seen
$\Gamma_5 \Xi_c 2\pi$	seen
$\Gamma_6 \Xi_c' \pi$	seen
$\Gamma_7 \Xi_c(2645) \pi$	seen

$\Xi_c(2970)$ BRANCHING RATIOS

$\Gamma(\Lambda_c^+ \bar{K} \pi)/\Gamma_{\text{total}}$	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	EPTS 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.

$\Gamma(\Sigma_c(2455) \bar{K})/\Gamma(\Lambda_c^+ \bar{K} \pi)$	Γ_2/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
$0.55 \pm 0.07 \pm 0.13$	AUBERT 08J BABR $e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi_c' \pi)/\Gamma_{\text{total}}$	Γ_6/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	YELTON 16 BELL e^+e^- , Υ regions

$\Gamma(\Xi_c(2645) \pi)/\Gamma_{\text{total}}$	Γ_7/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	LESIK 08 BELL $e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi'_c \pi)/\Gamma(\Xi_c(2645)\pi)$			Γ_6/Γ_7		
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$1.67 \pm 0.29^{+0.15}_{-0.09} \pm 0.25$	778	¹ MOON	21	BELL	e^+e^- at $\Upsilon(nS)$

¹Measurement of the ratio of $\Xi_c(2970)^+ \rightarrow \Xi_c(2645)^0 \pi^+$ versus $\Xi_c(2970)^+ \rightarrow \Xi_c^{*0} \pi^+$. 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 $\Xi_c(2970)^+ \rightarrow \Xi_c(2645)^0 \pi^+$. 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

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