Status Report

Taejin Moon

29 Jan, 2020

Error in PDG

- Mass of $\Xi_c(2970)$ -

$\Xi_c(2970)$ $I(J^P) = 1/2(?^?)$
was $\Xi_c(2980)$

$\Xi_c(2970)$ MASSES	
$\Xi_c(2970)^+$ MASS	2969.4 ± 0.8 MeV (S = 1.1)
$\Xi_c(2970)^0$ MASS	$2967.8^{+0.9}_{-0.7}$ MeV (S = 1.1)
$\Xi_c(2970)$–Ξ_c MASS DIFFERENCES	
$m_{\Xi_c(2970)^+} - m_{\Xi_c^0}$	498.5 ± 0.8 MeV (S = 1.1)
$m_{\Xi_c(2970)^0} - m_{\Xi_c^+}$	$499.9^{+0.8}_{-0.7}$ MeV (S = 1.1)
$\Xi_c(2970)^+ - \Xi_c(2970)^0$ MASS DIFFERENCE	$1.5^{+1.1}_{-1.2}$ MeV (S = 1.1)
$\Xi_c(2970)$ WIDTHS	
$\Xi_c(2970)^+$ WIDTH	$20.9^{+2.4}_{-3.5}$ MeV (S = 1.2)
$\Xi_c(2970)^0$ WIDTH	$28.1^{+3.4}_{-4.0}$ MeV (S = 1.5)

	PDG	Yelton's
$\Xi_c(2970)^+$	2969.4	2966.4
$\Xi_c(2970)^0$	2967.8	2970.8

- Source of the information in the red box ($\Xi_c(2970)$-Ξ_c mass difference) is pure Yelton's paper.
- PDG made mistake assigning the charges of Ξ_c ground state:
  - $M_{\Xi c(2970)+} - M_{\Xi c\mathbf{0}}$ instead of $M_{\Xi c(2970)+} - M_{\Xi c+}$ for 498.5 MeV diff.
  - $M_{\Xi c(2970)\mathbf{0}} - M_{\Xi c+}$ instead of $M_{\Xi c(2970)\mathbf{0}} - M_{\Xi c\mathbf{0}}$ for 499.9 MeV diff.
- They use **false** Yelton's value instead **true** Yelton's value, i.e.
  - $M_{\Xi c(2970)+}$: 2969.4 instead of 2966.4
  - $M_{\Xi c(2970)0}$: 2967.4 instead of 2970.8

	PDG	False Yelton's
$\Xi_c(2970)^+$	2969.4	2969.4
$\Xi_c(2970)^0$	2967.8	2967.4

- Since uncertainty of Yelton's is lower at least factor of 2 and much larger statistics, false Yelton's value **almost determine PDG value.**

Error in PDG
- Mass of Ξc(2970) -

$\Xi_c(2970)^0$ MASS

INSPIRE search

The evidence is statistically weaker for this charge state.

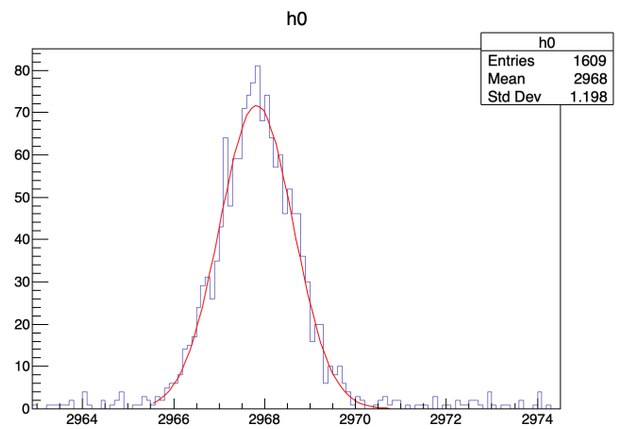
VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$2967.8^{+0.9}_{-0.7}$	**OUR FIT** Error includes scale factor of 1.1.				
2968.0 ± 2.6	**OUR AVERAGE** Error includes scale factor of 1.2.				
2972.9 ±4.4 ±1.6	67 ±44	AUBERT	2008J	BABR	e^+e^- ≈ 10.58 GeV
2965.7 ±2.4 $^{+1.1}_{-1.2}$	57 ±13	LESIAK	2008	BELL	e^+e^- ≈ $\Upsilon(4S)$
2977.1 ±8.8 ±3.5	42 ±24	CHISTOV	2006	BELL	e^+e^- ≈ $\Upsilon(4S)$

# of EVTS for Ξ(2970)⁰ : 916

True Yelton's : 2970.8

False Yelton's : 2967.4

- For example (neutral one is simpler),
  - Considering the three listed above only: **OUR FIT** shows too small value and too small uncentainty.
  - Using the three above + true Yelton's : **OUR AVERAGE** never become less than 2970.
  - Using the three above + false Yelton's :
    - Assuming gaussian for each and generating randoms with each EVTS
    - I can reproduce **2967.8 ± 0.8 MeV**



EXT	PARAMETER		
NO.	NAME	VALUE	ERROR
1	Constant	7.16487e+01	2.37800e+00
2	Mean	2.96782e+03	2.15823e-02
3	Sigma	8.10148e-01	1.69014e-02

- I reported the error to PDG.

Efficiency

- For $\Xi_c(2970)^+ \rightarrow \Xi_c(2645)^0\pi^+ \rightarrow \Xi_c^+\pi^-\pi^+$ decay,
  - Mass cut on $\Xi_c(2645)^0$ of ±5MeV are applied.

$\Xi_c(2645)$ **WIDTHS**

$\Xi_c(2645)^+$ WIDTH	2.14 ± 0.19 MeV (S = 1.1)
$\Xi_c(2645)^0$ WIDTH	2.35 ± 0.22 MeV

- Currently, I omitted the natural width of $\Xi_c(2645)^0$.
- I am regenerating MC files with proper natural width of $\Xi_c(2645)^0$.