Best Candidate Selection

BCS for $\Xi_c(2970)^+$ from $\Xi_c'^0\pi^+$

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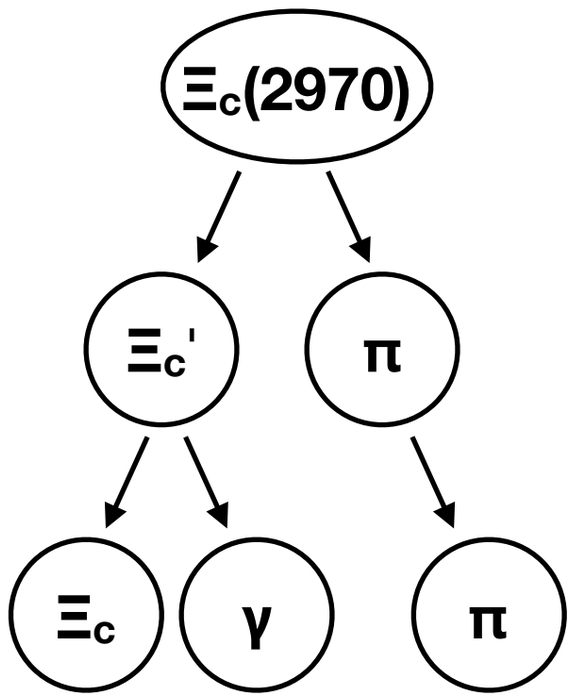
$\Xi_c(2970) \rightarrow \Xi_c{}'\pi$



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f) In the case of particles decaying to Ξ_c' only one Ξ_c' is allowed per event, to eliminate double-counting in events with noise photons

< from p.1 of bn1380 v2.0 >

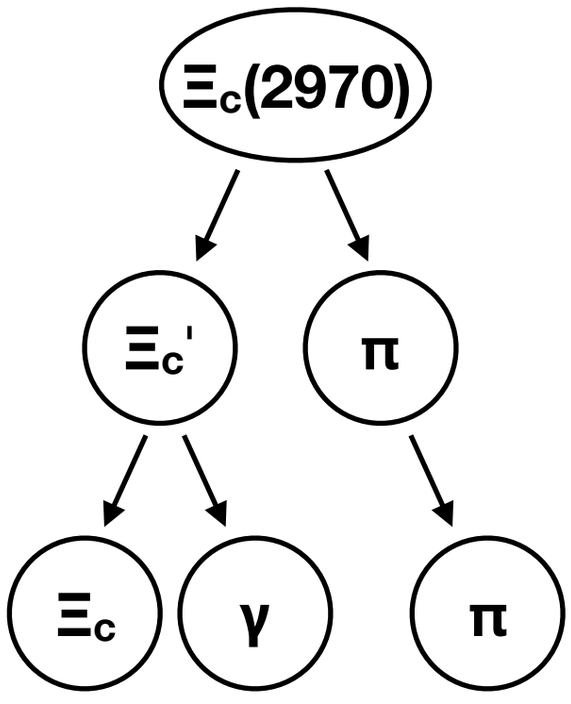
Because there is a good deal of background from noise "photons", there is a possibility of falsely enhancing any peak in Ξ_c'/π distributions by having individual events enter the plots twice at similar total masses – once with the correct photon and once with a noise photon which is nearby. To reduce this effect, if there were multiple candidates in one event with the same transition pion but different Ξ_c' candidates, only the one with the Ξ_c' mass closest to the peak value was used. This reduced the final signal by around 10% but did not significantly change the mass and width values obtained.

< from p.24 of bn1380 v2.0 >

$\Xi_c(2645) \to \Xi_c$ decay. It is possible for background photons, particularly of low energy, to combine with the Ξ_c ground states to make Ξ_c' candidates. Once constrained to the Ξ_c' mass, several such candidates in one event can combine with a pion from a higher state to make multiple entries in this plot, all at similar total masses. To avoid this, we require that if there are multiple Ξ_c' candidates of this type in an event, only the one with an unconstrained mass closest to the Ξ_c' mass is considered. This reduces the overall population of the plot by around 15%.

< from 9th page of the publication >

J. Yelton et. al.,PRD 94, 052011 (2016)



Logic for BCS

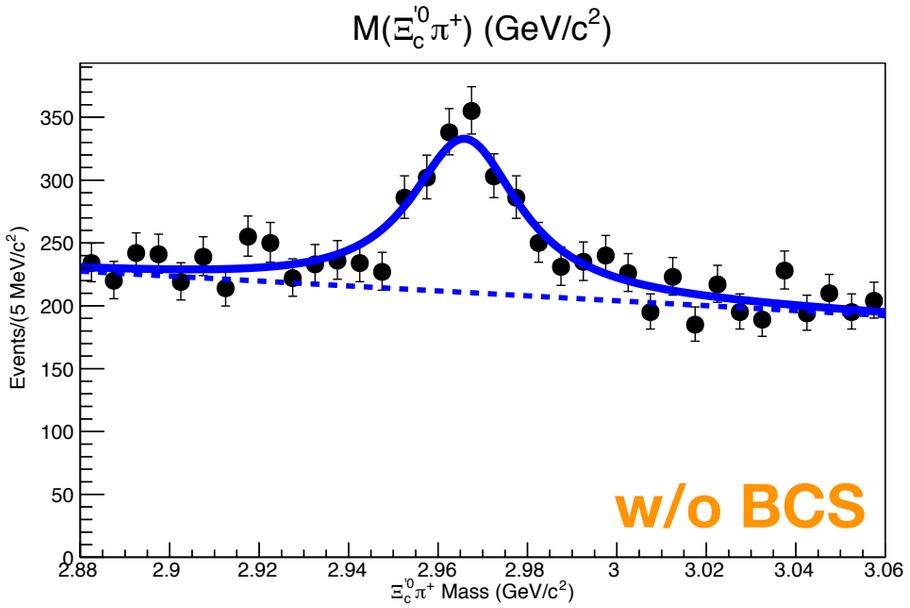
	$\Xi_c'^1$	$\Xi_c'^2$	$\Xi_c'^3$
π_1	$\Xi_c(2970)$ cand 1	-	$\Xi_c(2970)$ cand 2
π_2	-	$\Xi_c(2970)$ cand 3	-
π_3	-	-	-

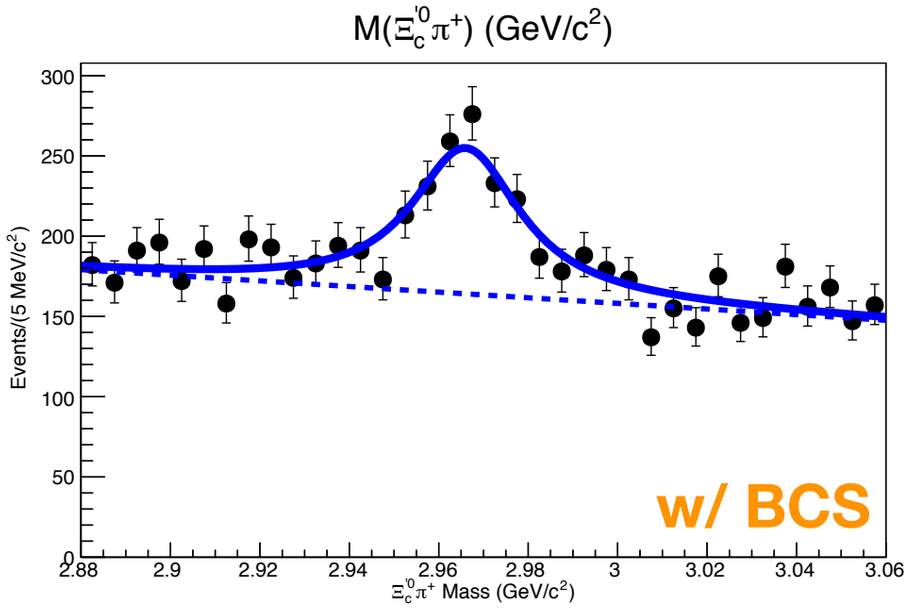
- In a event,
- Among $\Xi_c(2970)$ candidates which come from $\pi + \Xi_c'$,
  - For each pion,
    - If there is only one Ξ_c' partner, then flag==1 for $\Xi_c(2970)$ candidate 3
    - If there are multiple partners,
      - let $M(\Xi_c'^3)$ be closer to $\Xi c'$ mass than $M(\Xi_c'^1)$
      - then flag==1 for $\Xi_c(2970)$ candidate 2
      - then flag==0 for $\Xi_c(2970)$ candidate 1

Fitting Result

$\Xi_c(2970)^+ \rightarrow \Xi_c'^0\,\pi^+ \rightarrow \Xi_c^0\,\gamma\,\pi^+$

Angle integrated data.

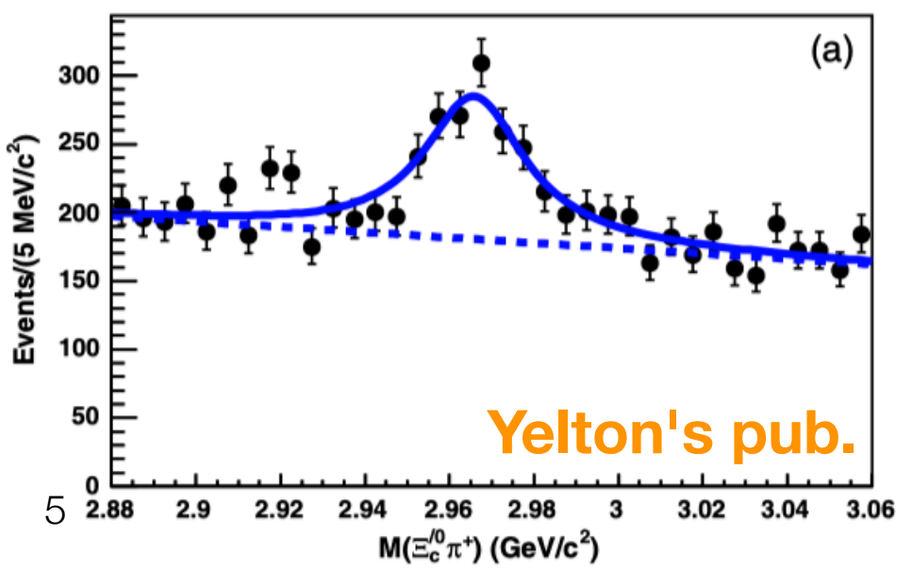




	w/o BCS	w/ BCS	w/o → w/	cf. Yelton's
Total Entries	8553	6622	-22.6%	~7300
Yield	997	740	-25.7%	845

- Mass : 2966.0 MeV/c^2 (fixed)
- width: 28.1 MeV/c (fixed)

- Cut condition
  - $x_p > 0.7$
  - Window for M(Ξ_c'): ± 8 MeV
  - $E_\gamma > 100$ MeV
  - Proper charge of π selected .
  - χ^2 vertex fitting for Ξc(2970) < 30
  - Window for M(Ξ_c): ±2σ



Summary

- By applying BCS, total entries decrease by 22.6% and yields decrease by 25.7%
- Statistics and peak shape are still different.
  - Total entries and yields w/ BCS is 90.7% and 87.6% of those in the Yelton's publication result, respectively.
  - BCS doesn't change peak shape so much.