Recent results on the charmed baryon physics at BESIII

Yingchao Xu

On behalf of the BESIII Collaboration

第二十二届全国重味物理和CP破坏研讨会（HFCPV2025）

2025年10月24日-10月28日，北京

烟台大学
YANTAI UNIVERSITY

BESIII

Outline

- Introduction of the lightest charm baryon Λ_c^+
- Recent results on the charmed baryon physics at BESIII

➢ Λ_c^+ semi-leptonic decays

➢ Λ_c^+ hadronic decays

➢ Λ_c^+ inclusive decay

➢ Cross section

➢ Transverse polarization

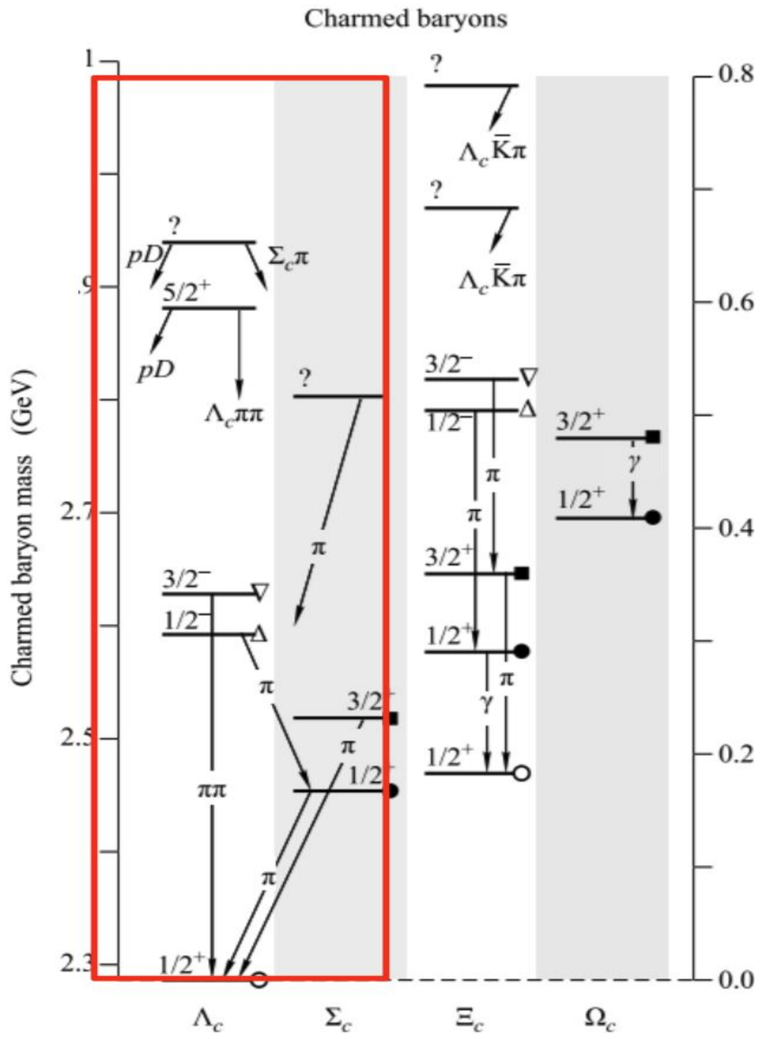
- Summary

Charmed baryon spectroscopy

- Before 2014, the charmed baryons have been produced and studied at many experiments, notably fixed-target experiments (such as FOCUS and SELEX) and e^+e^- B-factories (ARGUS, CLEO, BABAR, and BELLE).
- Large uncertainties in experiment=>Retarder development in theory.

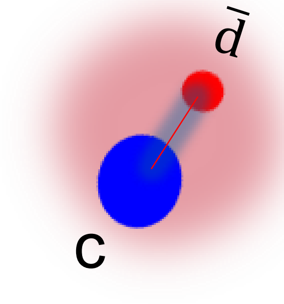
- Afterwards, more extensive measurements on charmed baryons are performed at BESIII, BELLE and LHCb.
  - The absolute BF measurements at BESIII and BELLE.
  - The observation of the DCS mode $\Lambda_c^+ \to pK^+\pi^-$ at BELLE.
  - The observation of the doubly charmed baryon Ξ_{cc}^{++} at LHCb.

- These experimental progresses have evoked the activities in the theoretical efforts



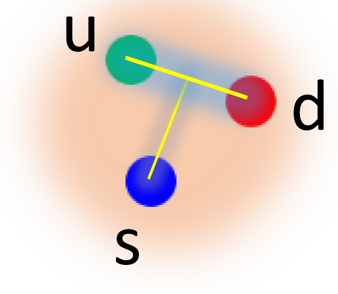
Λ_c^+: The lightest charmed baryon spectroscopy

- Most of the charmed baryons will eventually decay to $\mathbf{\Lambda_c^+}$.
- The $\mathbf{\Lambda_c^+}$ is one of important tagging hadrons in c-quark counting in the productions at high energy experiment.
- Also important input to $\boldsymbol{\Lambda_b}$ (including $\mathbf{\Xi_{cc}^{++}}$) physics as $\boldsymbol{\Lambda_b}$ decay preferentially to $\boldsymbol{\Lambda_c}$.
  ==>Important input to B physics and V_{ub} calculations.
- $\mathbf{\Lambda_c^+}$ may provide more powerful test on internal dynamics than D/Ds does!
- Naive quark model picture: a heavy quark (*c*) with an unexcited spin-zero diquark (*u*-*d*). Diquark correlation is enhanced by weak Color Magnetic Interaction with a heavy quark (HQET).



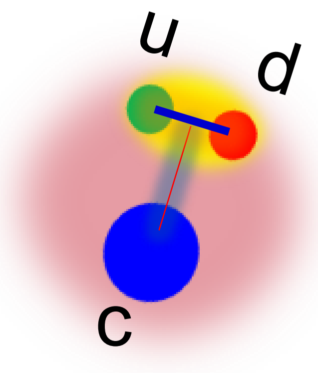
→ Charmed meson ($D^+[c\bar{d}]$)

$m_d \ll m_c$ →
quark + heavy quark
(q) (Q)



→ Strange baryons (**Λ[uds]**)

m_u, $m_d \approx m_s$ →
(qqq) uniform

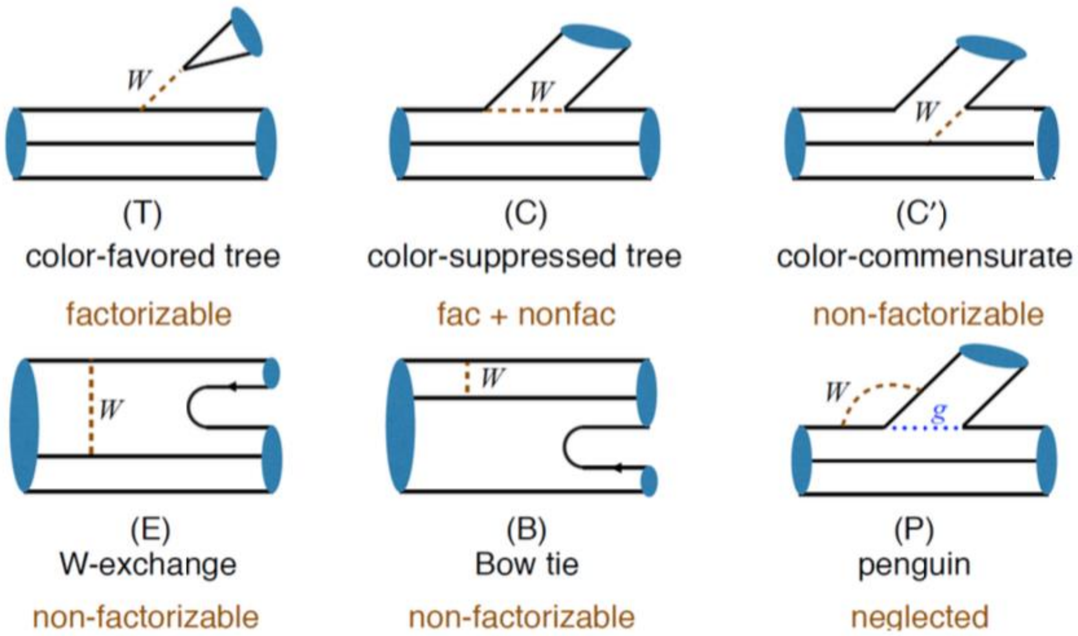


→ Charmed baryon (Λ_c**[udc]**)

m_u, $m_d \ll m_c$ →
diquark + quark
(qq) (Q)

Λ_c^+ weak decays

- Contrary to charmed meson, W-exchange contribution is important. (No color suppression and helicity suppression)

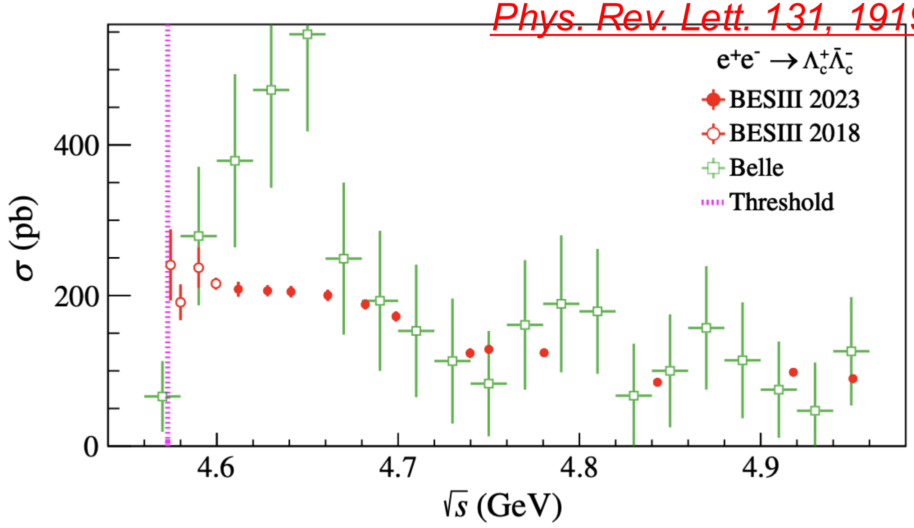


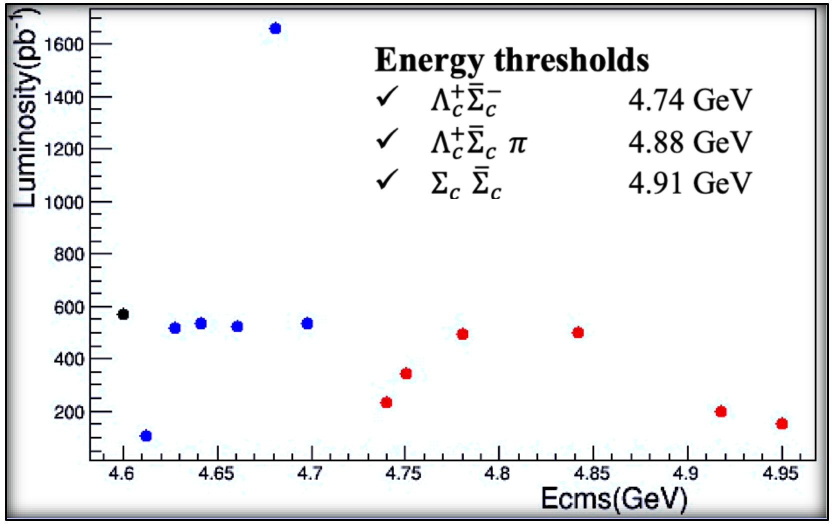
- Phenomenology aims to explain data and predict important observables.
- Calculate what they can (HQET, factorization) + parametrize what they cannot + some non-factorization processes extracted from data => explain and predict.

BESIII data taking at Λ_c^+ pair threshold

- Measurement using the threshold pair-productions via e^+e^- annihilations is unique: the most simple and straightforward.
- In 2014, BESIII took data above Λ_c^+ pair threshold and run machine at 4.6 GeV with excellent performance! ~106× 10^3 $\Lambda_c^+\Lambda_c^-$ pairs make sensitivity to 10^{-3}.
- First time to systematically study Λ_c^+ at threshold.
- From December 2019 to June 2021, the BESIII experiment collected approximately 5.85 fb^{-1} of data at center-of-mass energies between 4.61 and 4.95 GeV.
- Will allow to improve the precision of Λ_c^+ decay rates to a level comparable to the charmed mesons.
- Provide an opportunity to study many unexplored physics observables related to Λ_c^+ decays.
- Boost our understanding of the non-perturbative effects in the charmed baryon sector.

Phys. Rev. Lett. 131, 191901 (2023)

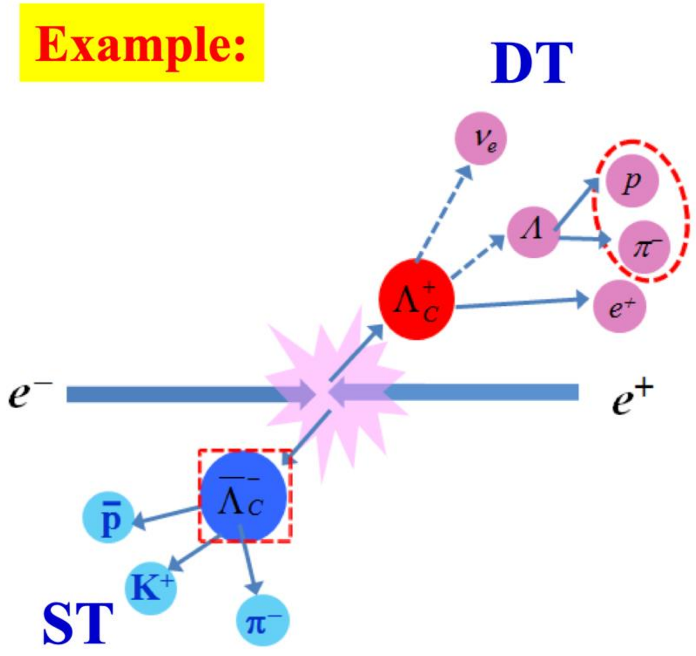




CPC 46, 113003 (2022)

Production near threshold and tag technique

- $\Lambda_c^+\Lambda_c^-$ produced in pairs with no additional accompany hadrons (4.6~4.7 GeV).
- Clean backgrounds and well constrained kinematics.



- Single Tag (ST)

$$\Delta E = E_{\Lambda_c^+} - E_{beam}$$

$$M_{BC} = \sqrt{E_{beam}^2 - \left|\vec{p}_{\Lambda_c^+}\right|^2}$$

- Double Tags (DT)

$$U_{miss} = E_{miss} - |\vec{p}_{miss}|$$

$$M_{miss} = \sqrt{E_{miss}^2 - |\vec{p}_{miss}|^2}$$

- Branching Fraction ($\mathcal{B}$)

$$\mathcal{B}_{SL} = \frac{N_{SL}}{N^{tag} \times \epsilon}$$

Recent results on the charmed baryon physics at BESIII

➢ Λ_c^+ semi-leptonic decays

- $\Lambda_c^+ \to n e^+ \nu_e$ *Nat Commun 16, 681 (2025)* Machine learning technique

➢ Λ_c^+ hadronic decays

- $\Lambda_c^+ \to \Xi^0 K^+$ *Phys.Rev.Lett. 132, 031801 (2024)* Decay Asymmetry in the Pure W-Boson-Exchange decay
- $\Lambda_c^+ \to \Lambda \pi^+ \eta$ *Phys.Rev.Lett. 134, 021901 (2025)* Partial wave analysis
- $\Lambda_c^+ \to p K_{L,S}^0, p K_{L,S}^0 \pi^+ \pi^-, p K_{L,S}^0 \pi^0$ *JHEP 09 ,007(2024)* Measurements of $K_S^0 - K_L^0$ asymmetries
- $\Lambda_c^+ \to p \pi^0, p \eta$ *Phys.Rev.D 109, L091101 (2024)*
- $\Lambda_c^+ \to \Lambda K_S^0 K^+, \Xi^0 K_S^0 \pi^+, \Sigma^0 K_S^0 K^+$ *Phys. Rev. D 112, 032006(2025)*
- $\Lambda_c^+ \to \Sigma^0 K^+ \pi^0, \Sigma^0 K^+ \pi^+ \pi^-$ *2502.11047 (CPC accepted)*
- $\Lambda_c^+ \to \Sigma^+ \eta, \Sigma^+ \eta'$ *2505.18004 (JHEP accepted)*
- $\Lambda_c^+ \to n K_S^0 \pi^+ \pi^0$ *Phys.Rev.D 109, 053005 (2024)*
- $\Lambda_c^+ \to \Lambda K^+ \pi^0, \Lambda K^+ \pi^+ \pi^-$ *Phys.Rev.D 109, 032003 (2024)*
- $\Lambda_c^+ \to \Xi^0 K^+ \pi^0, n K^+ \pi^0, \Sigma^0 K^+ \pi^0, \Lambda K^+ \pi^0$ *Phys.Rev.D 109, 052001 (2024)*
- $\Lambda_c^+ \to n K_S^0 \pi^+, n K_S^0 K^+$ *Phys.Rev.D 109, 072010 (2024)*
- $\Lambda_c^+ \to \Lambda K_S^0 K^+, \Lambda K_S^0 \pi^+, \Lambda K^{*+}$ *Phys.Rev.D 111, 012014 (2025)*
- $\Lambda_c^+ \to \Sigma^- K^+ \pi^+$ *Phys.Rev.D 109 , L071103 (2024)*

Recent results on the charmed baryon physics at BESIII

➢Λ_c^+ inclusive decay

- $\Lambda_c^+ \to K_S^0 X$ *JHEP06,194(2025)*

➢$\Lambda_c(2625)^+$ $\Lambda_c(2595)^+$ decay

- $\Lambda_c(2595)^+ \to \Lambda_c^+\pi^0\pi^0, \Lambda_c(2625)^+ \to \Lambda_c^+\pi^0\pi^0$ *JHEP 08 ,065 (2025)*
- $\Lambda_c(2595)^+ \to \Lambda_c^+\pi^+\pi^-, \Lambda_c(2625)^+ \to \Lambda_c^+\pi^+\pi^-$ *Phys.Rev.D 109, 112007 (2024)*

➢Cross section

- $e^+e^- \to \Lambda_c^+\bar{\Lambda}_c(2595)^-, \Lambda_c^+\bar{\Lambda}_c(2625)^-$ *Phys. Rev. D **109**, L071104(2024)*
- $e^+e^- \to \Sigma_c\bar{\Sigma}_c, \Lambda_c^+\bar{\Sigma}_c^-$ 2508.16871 *(PRD Submitted)*

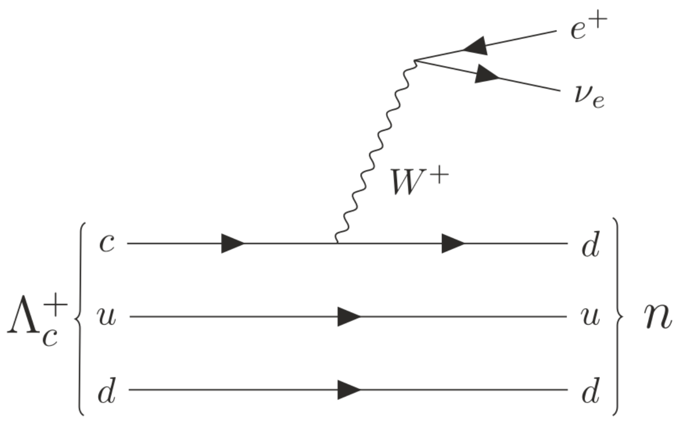
➢Transverse polarization

- The Production and Decay Dynamics of the Charmed Baryon Λ_c^+ in e^+e^- Annihilations near Threshold *2508.11400 (PRX Submitted)*

Study of $\Lambda_c^+ \to n e^+ \nu_e$ decays

$4.5\ \mathrm{fb}^{-1} @ E_{cm} = 4.600 - 4.700\ \mathrm{GeV}$ Nat Commun 16, 681 (2025)

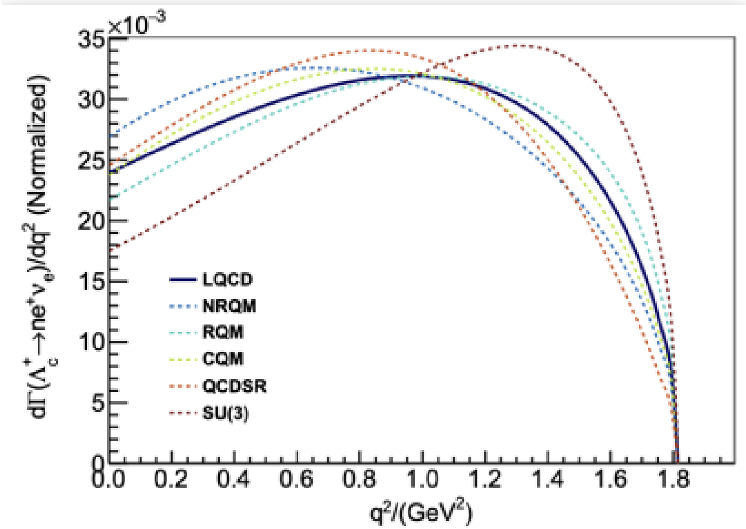
Important input for the implementing and calibrating the LQCD calculation.
Semi-leptonic decay of charm baryon $\Lambda_c^+ \to \Lambda e^+ \nu_e$ has been observed by BESIII.

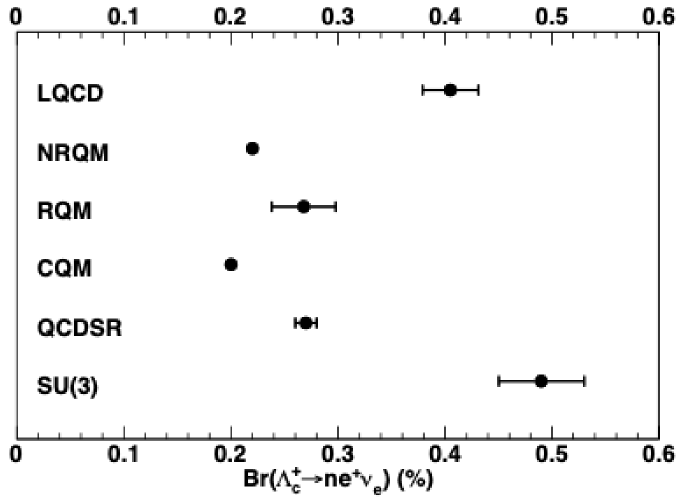


$\mathcal{B}(\Lambda_c^+ \to \Lambda e^+ \nu_e) = 3.56 \pm 0.11 \pm 0.07$ Phys. Rev. Lett. 129, 231803 (2022).

$\mathcal{B}(\Lambda_c^+ \to X e^+ \nu_e) = 4.06 \pm 0.10 \pm 0.09$ Phys. Rev. D 107, 052005 (2023)

The CS transition $c \to d \ell^+ \nu$ never been observed in Λ_c^+ decay.
Challenges: Two missing particles; High background from $\Lambda_c^+ \to \Lambda e^+ \nu_e$

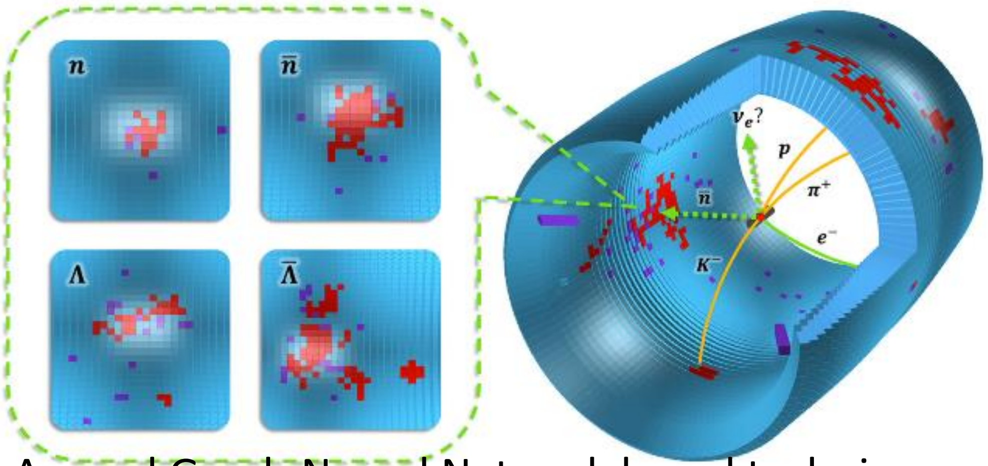




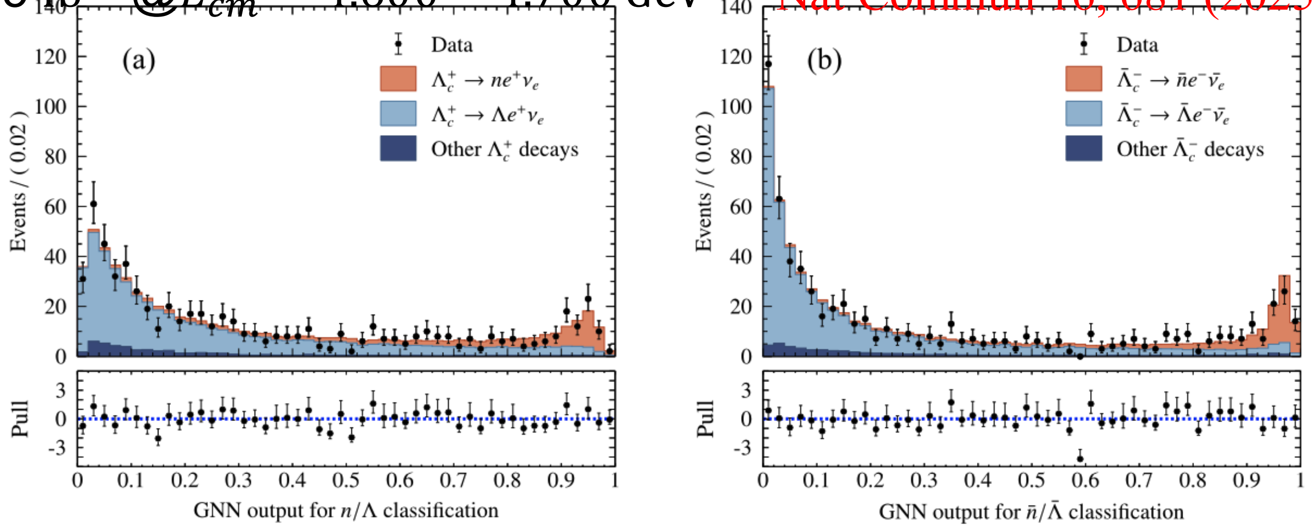
Study of $\Lambda_c^+ \to n e^+ \nu_e$ decays

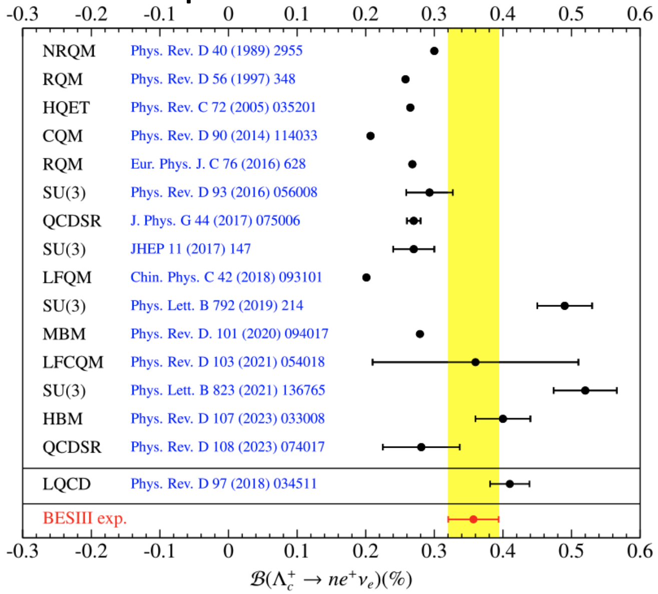
$4.5\ \mathrm{fb}^{-1}@E_{cm} = 4.600 - 4.700$ GeV

Nat Commun 16, 681 (2025)



A novel Graph Neural Network based technique





This article presents the first observation of the Cabibbo- suppressed decay $\Lambda_c^+ \to n e^+ \nu_e$.

$$\mathcal{B}(\Lambda_c^+ \to n e^+ \nu_e) = (3.57 \pm 0.34 \pm 0.14) \times 10^{-3}$$

$$|V_{cd}| = 0.208 \pm 0.011 \pm 0.007 \pm 0.001$$

$$\mathcal{B}(\Lambda_c^+ \to \Lambda e^+ \nu_e) = 3.56 \pm 0.11 \pm 0.07$$

$$\mathcal{B}(\Lambda_c^+ \to X e^+ \nu_e) = 4.06 \pm 0.10 \pm 0.09$$

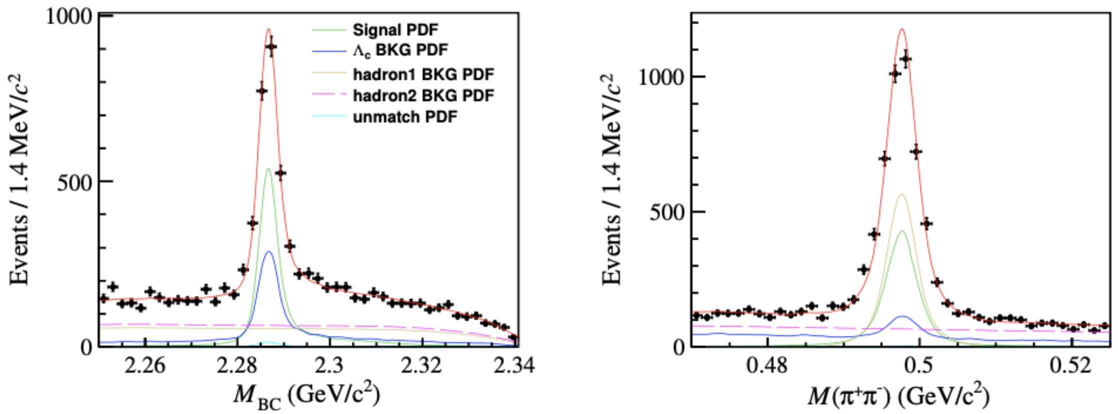
This work highlights a new approach to further understand fundamental interactions in the charmed baryon sector, and showcases the power of modern machine learning techniques in experimental high-energy physics.

Improved measurement of inclusive decay $\Lambda_c^+ \to K_S^0 X$

4.5 fb^{-1}@$E_{cm} = 4.600 - 4.700$ GeV JHEP06,194(2025)

The Cabibbo-favored (CF) decays are the dominant decay modes of Λ_c^+. According to the statistical isospin model, the sum of the BFs of both observed and predicted CF decays of Λ_c^+ is $(83.2 \pm 4.9)\%$, mainly involving Λ, Σ, Ξ and $\bar{K}^0$ in the final state.

Mode	Value	Mode	Value
Observed BF		Predicted BF	
$p\bar{K}^0$	$(3.18 \pm 0.14)\%$	$n\bar{K}^0\pi^+\pi^0$	$(3.07 \pm 0.16)\%$
$p\bar{K}^0\pi^0$	$(3.92 \pm 0.24)\%$	$p\bar{K}^0\pi^0\pi^0$	$(1.36 \pm 0.07)\%$
$p\bar{K}^0\pi^+\pi^-$	$(3.18 \pm 0.22)\%$	$n\bar{K}^0\pi^+\pi^+\pi^-$	$(0.14 \pm 0.09)\%$
$n\bar{K}^0\pi^+$	$(3.64 \pm 0.50)\%$	$p\bar{K}^0\pi^+\pi^-\pi^0$	$(0.22 \pm 0.14)\%$
$p\bar{K}^0\eta$	$(0.88 \pm 0.06)\%$	$n\bar{K}^0\pi^+\pi^0\pi^0$	$(0.10 \pm 0.06)\%$
$\Lambda\bar{K}^0K^+$	$(0.56 \pm 0.11)\%$	$p\bar{K}^0\pi^0\pi^0\pi^0$	$(0.03 \pm 0.02)\%$
$\Sigma^+\phi, \phi \to K_L^0K_S^0$	$(0.13 \pm 0.02)\%$	$(\Sigma K)^+\bar{K}^0$	$(0.68 \pm 0.34)\%$
$\Sigma^+K^{*0}, K^{*0} \to K^0\pi^0$	$(1.16 \pm 0.33) \times 10^{-3}$	$\Xi^0K^0\pi^+$	$(0.62 \pm 0.06)\%$
$p\bar{K}^0K^0$	$(9.40 \pm 0.72) \times 10^{-4}$		
Σ^+K^0	$(9.40 \pm 2.80) \times 10^{-4}$		
$p\phi, \phi \to K_L^0K_S^0$	$(3.59 \pm 0.47) \times 10^{-4}$		
Sum	$(15.8 \pm 0.6)\%$		$(6.2 \pm 0.4)\%$
Total	$(22.0 \pm 0.7)\%$		



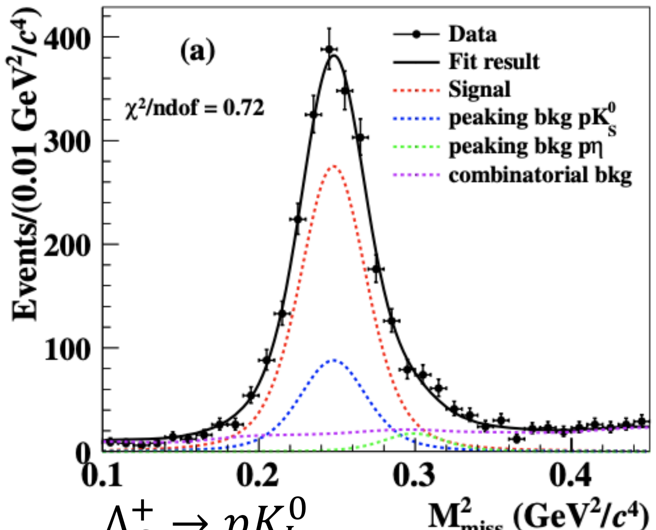
$$\mathcal{B}(\Lambda_c^+ \to K_S^0 X) = (10.9 \pm 0.2 \pm 0.1)\%$$

$$\mathcal{B}(\Lambda_c^+ \to \bar{K}^0/K^0 X) = (21.8 \pm 0.4 \pm 0.2)\%$$

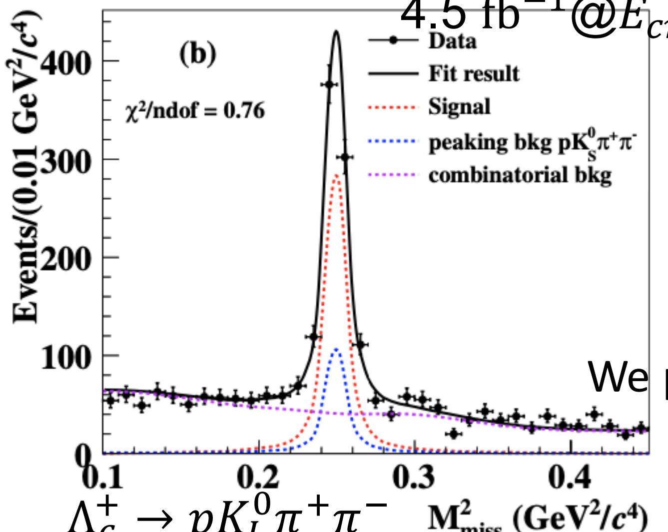
This result indicates that there are still undiscovered decay channels containing K_S^0 in the final state with a combined BF of $(3.0 \pm 0.4)\%$.

Measurements of $K_S^0 - K_L^0$ asymmetries

$4.5\ \mathrm{fb}^{-1}@E_{cm} = 4.600 - 4.700\ \mathrm{GeV}$ *JHEP 09 ,007(2024)*



$\Lambda_c^+ \to pK_L^0$



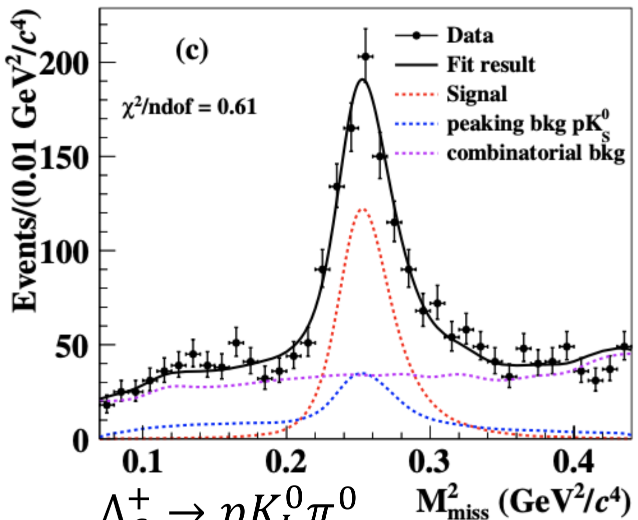
$\Lambda_c^+ \to pK_L^0\pi^+\pi^-$

$$\mathcal{B}(\Lambda_c^+ \to pK_L^0) = (1.67 \pm 0.06 \pm 0.04)\%$$
$$\mathcal{B}(\Lambda_c^+ \to pK_L^0\pi^+\pi^-) = (1.69 \pm 0.10 \pm 0.05)\%$$
$$\mathcal{B}(\Lambda_c^+ \to pK_L^0\pi^0) = (2.02 \pm 0.13 \pm 0,05)\%$$

We present the first measurements of $K_S^0 - K_L^0$ asymmetries

$$R(\Lambda_c^+, K_{S,L}^0X) = \frac{\mathcal{B}(\Lambda_c^+ \to K_S^0X) - \mathcal{B}(\Lambda_c^+ \to K_L^0X)}{\mathcal{B}(\Lambda_c^+ \to K_S^0X) + \mathcal{B}(\Lambda_c^+ \to K_L^0X)},$$

Mode	$\mathcal{B}(\Lambda_c^+ \to K_L^0X)$ (%)	$\mathcal{B}(\Lambda_c^+ \to K_S^0X)$ (%) [22]	$R(\Lambda_c^+, K_{L,S}^0X)$
$\Lambda_c^+ \to pK_{L,S}^0$	$1.67 \pm 0.06 \pm 0.04$	1.59 ± 0.07	-0.025 ± 0.031
$\Lambda_c^+ \to pK_{L,S}^0\pi^+\pi^-$	$1.69 \pm 0.10 \pm 0.05$	1.60 ± 0.11	-0.027 ± 0.048
$\Lambda_c^+ \to pK_{L,S}^0\pi^0$	$2.02 \pm 0.13 \pm 0.05$	1.96 ± 0.12	-0.015 ± 0.046



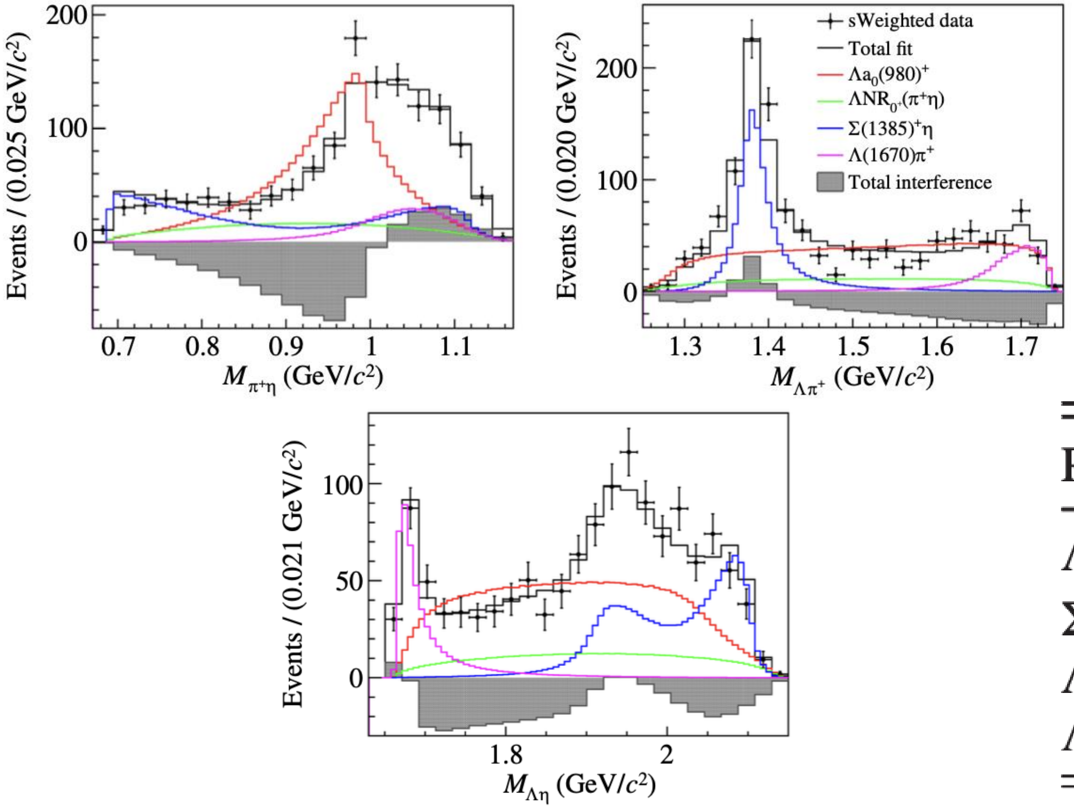
$\Lambda_c^+ \to pK_L^0\pi^0$

Taking into account the uncertainties, no obvious asymmetry is observed in any of the three decays. The asymmetry is compatible with the prediction of (−0.010, 0.087) based on SU(3) flavor symmetry

Partial wave analysis of $\Lambda_c^+ \to \Lambda\pi^+\eta$

Phys.Rev.Lett. 134, 021901 (2025)

6.1 $\mathrm{fb}^{-1}@E_{cm} = 4.600 - 4.843$ GeV



$\mathcal{B}(\Lambda_c^+ \to \Lambda a_0(980)^+) = (1.23 \pm 0.21)\%$ which differs significantly from the theoretical predictions evaluated in by 1–2 orders of magnitude.

$\mathcal{B}(\Lambda_c^+ \to \Lambda\pi^+\eta) = (1.94 \pm 0.07 \pm 0.01)\%$

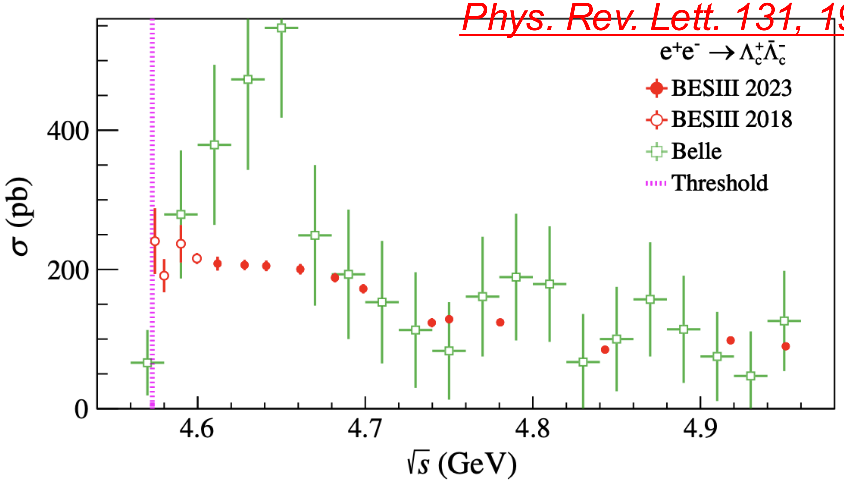
Process	FF (%)	$\mathcal{S}$	α
$\Lambda a_0(980)^+$	$54.0 \pm 8.4 \pm 2.6$	13.1σ	$-0.91^{+0.18}_{-0.09} \pm 0.08$
$\Sigma(1385)^+\eta$	$30.4 \pm 2.6 \pm 0.7$	22.5σ	$-0.61 \pm 0.15 \pm 0.04$
$\Lambda(1670)\pi^+$	$14.1 \pm 2.8 \pm 1.2$	11.7σ	$0.21 \pm 0.27 \pm 0.33$
ΛNR_{0^+}	15.4 ± 5.3	6.7σ	$\cdots$

The process $\Lambda_c^+ \to \Lambda a_0(980)^+$ is observed for the first time, and evidence for the pentaquark candidate $\Sigma(1380)^+$ decaying into $\Lambda\pi^+$ is found with statistical significance larger than 3σ with mass and width fixed to theoretical predictions.

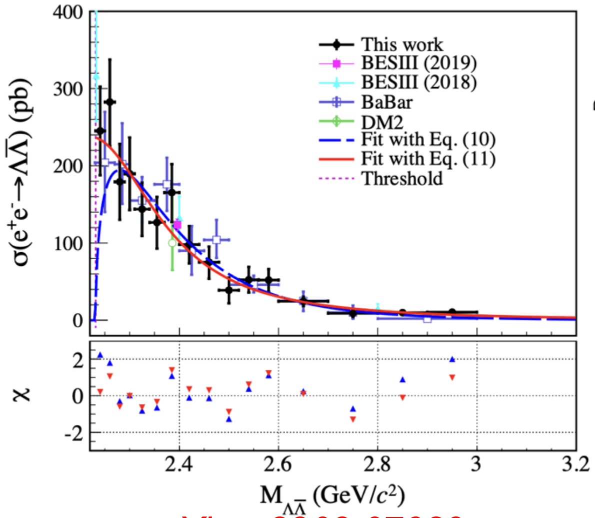
Cross section measurement of $e^+e^- \to \Sigma_c\bar{\Sigma}_c$、$\Lambda_c^+\bar{\Sigma}_c^-$

- Spin-1/2 baryons pairs ($B\bar{B}$) at threshold production
  - observe baryon's internal structures indirectly.
  - probe the understanding of strong interaction.
- The cross section of $e^+e^- \to \Lambda_c^+\bar{\Lambda}_c^-$ at threshold:
  - Belle - peak
  - BESIII - plateau

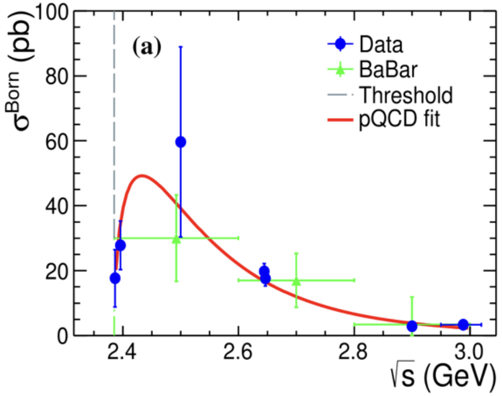
Phys. Rev. Lett. 131, 191901 (2023)



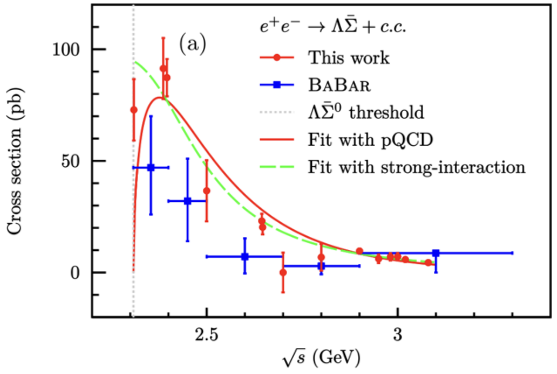
We measure the production of $e^+e^- \to \Sigma_c\bar{\Sigma}_c$、$\Lambda_c^+\bar{\Sigma}_c^-$ at threshold based on BESIII data collected.



arXiv：2303.07629



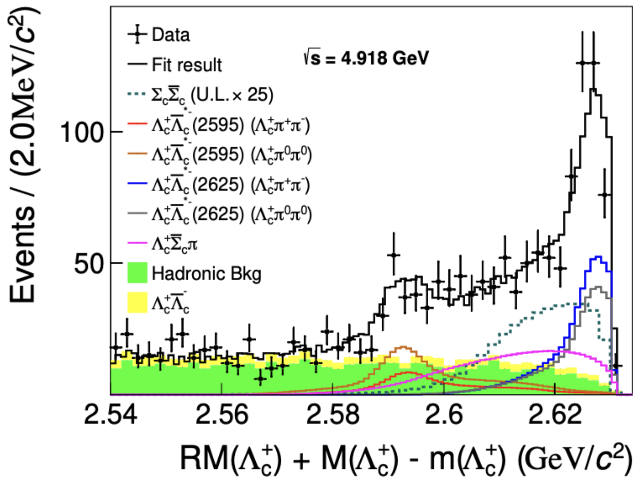
Phys. Lett. B 831, 137187 (2022)

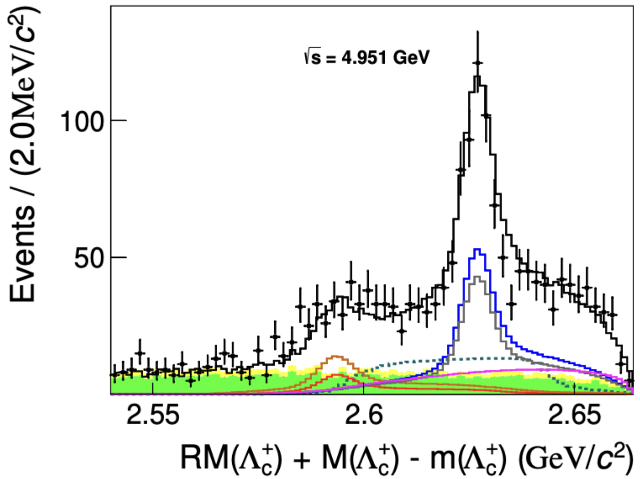


Phys. Rev. D 109, 012002 (2024)

E_{CMS} (MeV)	BOSS Version	Integral Luminosity (pb)
4750.05 ± 0.12 ± 0.29		366.55 ± 0.10 ± 1.95
4780.54 ± 0.12 ± 0.30		511.47 ± 0.12 ± 2.72
4843.07 ± 0.30 ± 0.32	7.0.7	525.16 ± 0.12 ± 2.79
4918.02 ± 0.34 ± 0.34		207.82 ± 0.08 ± 1.10
4950.93 ± 0.36 ± 0.38		159.28 ± 0.07 ± 0.85

Cross section measurement of $e^+e^- \to \Sigma_c\bar{\Sigma}_c$、$\Lambda_c^+\bar{\Sigma}_c^-$





2508.16871 *(PRD Submitted)*

The Born cross section of $e^+e^- \to \Sigma_c\bar{\Sigma}_c(\Sigma_c^+\bar{\Sigma}_c^-, \Sigma_c^0\bar{\Sigma}_c^0$ and $\Sigma_c^{++}\bar{\Sigma}_c^{--})$、$\Lambda_c^+\bar{\Sigma}_c^-$ have been measurement, no significant signals are observed.

TABLE IV. Summary of the upper limits on Born cross sections of $e^+e^- \to \Lambda_c^+\bar{\Sigma}_c^-$ at 90% C.L.. The results of $\sigma_{\rm Born}(e^+e^- \to \Lambda_c^+\bar{\Lambda}_c^-)$ are input from Ref. [20], where the first uncertainty represents statistical uncertainty and the second one represents systematic uncertainty.

$\sqrt{s}$	4.750 GeV	4.781 GeV	4.843 GeV	4.918 GeV	4.951 GeV
$R(\sigma)$ (%)	< 1.1	< 0.6	< 1.5	< 3.4	< 1.6
$\sigma_{\rm Born}(e^+e^- \to \Lambda_c^+\bar{\Lambda}_c^-)$ (pb)	$134 \pm 3 \pm 4$	$127 \pm 2 \pm 4$	$83 \pm 2 \pm 3$	$96 \pm 3 \pm 4$	$88 \pm 4 \pm 3$
$\sigma_{\rm Born}(e^+e^- \to \Lambda_c^+\bar{\Sigma}_c^-)$ (pb)	< 1.52	< 0.76	< 1.26	< 3.26	< 1.38

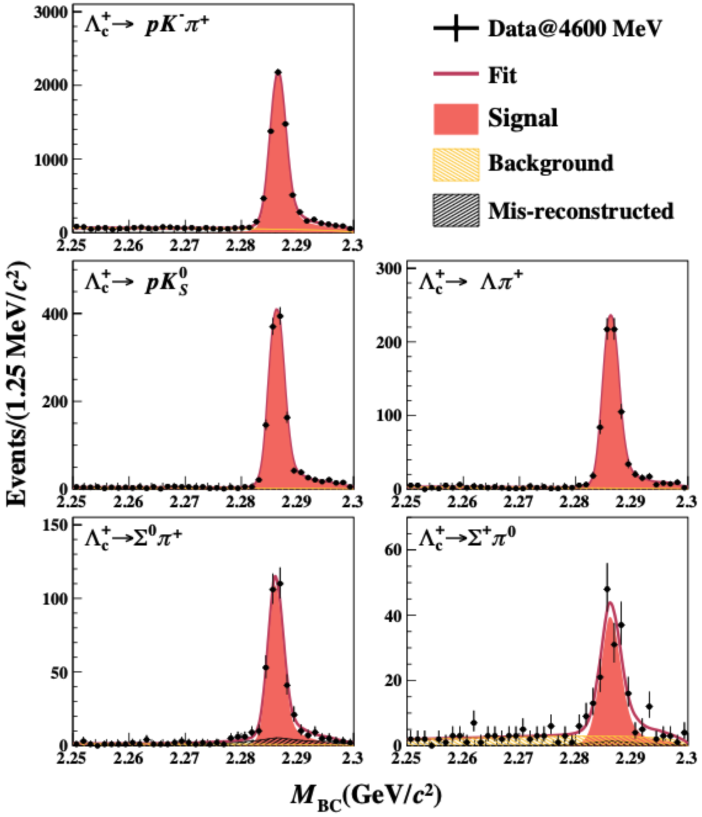
TABLE III. Summary of $f_{\rm VP}$, $f_{\rm ISR}$ and $\sigma_{\rm Born}(e^+e^- \to \Sigma_c\bar{\Sigma}_c)$, based on different assumptions of line shapes: 1. baseline model adopting $e^+e^- \to \Lambda_c^+\bar{\Lambda}_c^-$ measurements from Ref. [20]; 2. threshold-enhanced hypothesis (Hypothesis 1); 3. non-enhanced scenario (Hypothesis 2). All upper limits are set at the 90% C.L., and do not include the systematic uncertainties.

$\sqrt{s}$	f	baseline	Hypothesis 1	Hypothesis 2
4.918 GeV	$f_{\rm VP}$	1.06	1.06	1.06
	$f_{\rm ISR}$	0.96	0.68	0.58
	$\sigma_{\rm Born}$	< 0.55 pb	< 0.61 pb	< 0.83 pb
4.951 GeV	$f_{\rm VP}$	1.06	1.06	1.06
	$f_{\rm ISR}$	0.96	0.81	0.79
	$\sigma_{\rm Born}$	< 0.34 pb	< 0.39 pb	< 0.49 pb

Observation of the transverse polarization of Λ_c^+

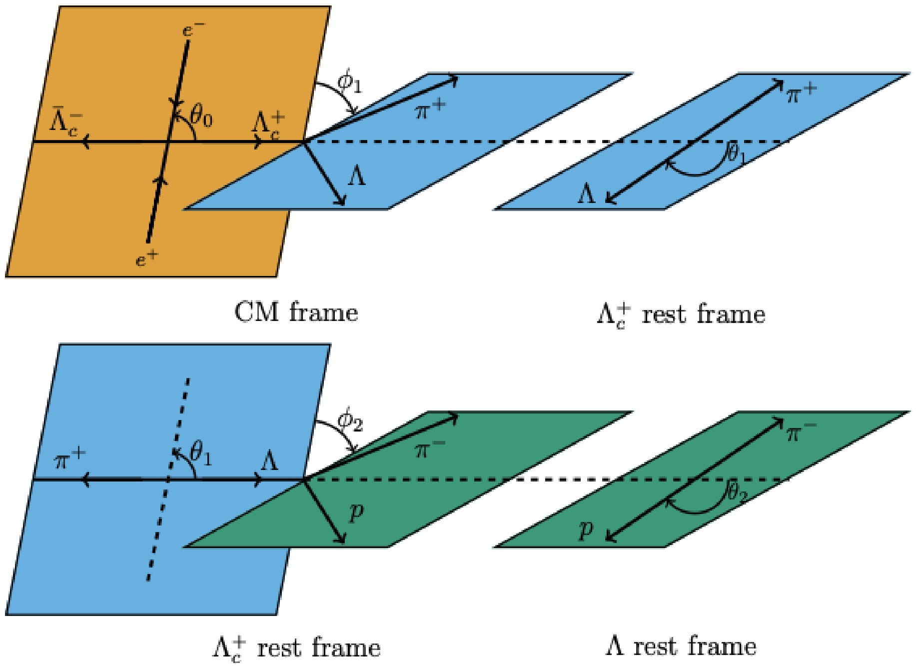
The study of the charmed baryons is crucial for investigating the strong and weak interactions in the Standard Model and for gaining insights into the internal structure of baryons。

We present the first observation of the transverse polarization of Λ_c^+ in the reaction $e^+e^- \to \Lambda_c^+\bar{\Lambda}_c^-$.



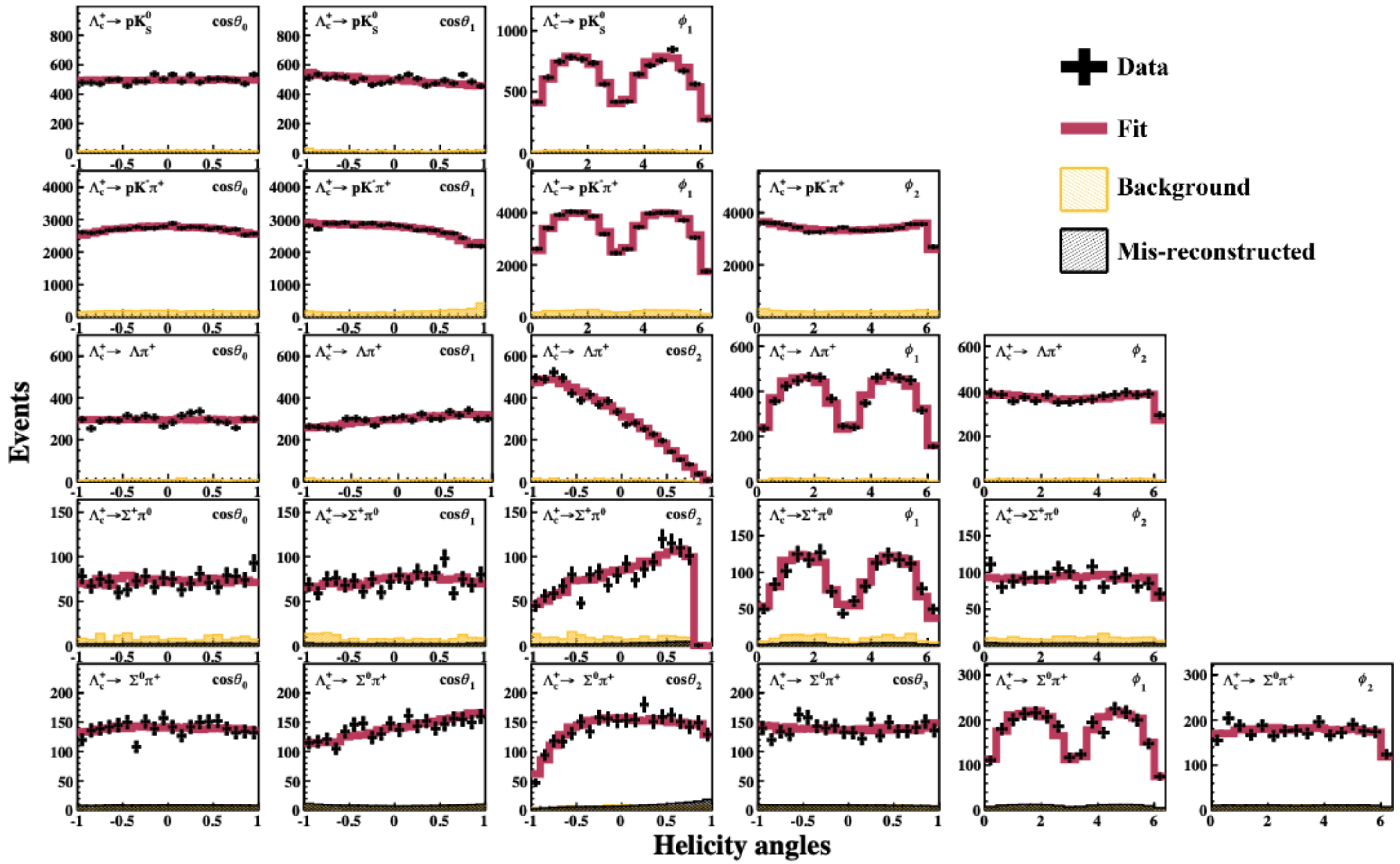
2508.11400 (PRX Submitted)

$6.4\text{fb}^{-1}@E_{cm} = 4.600 - 4.951$ GeV



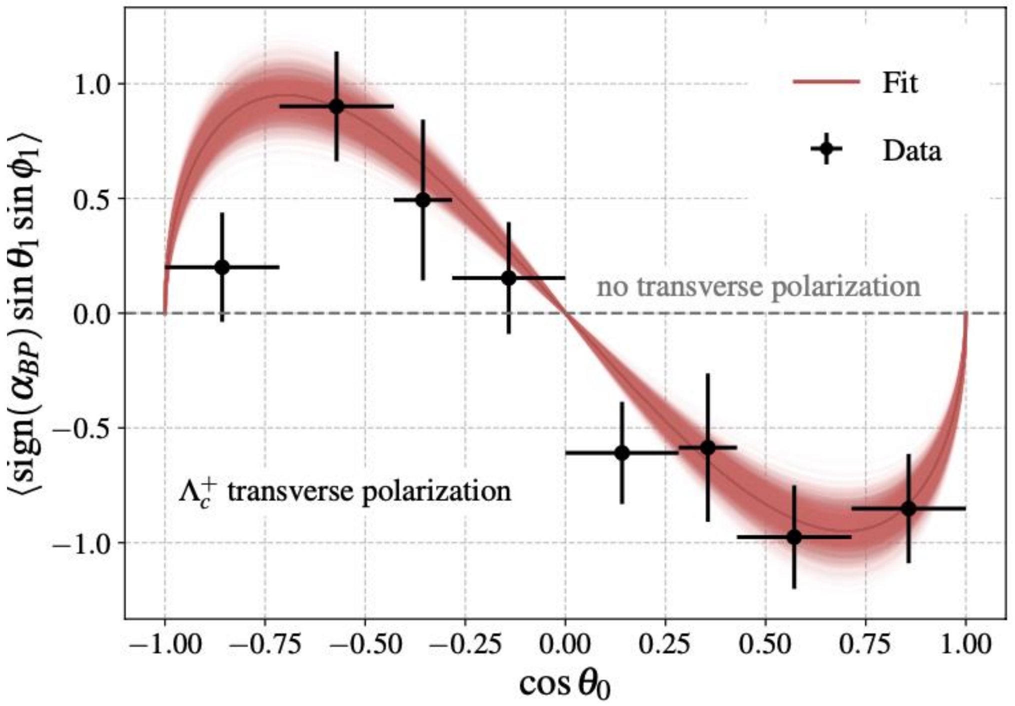
$$
\begin{aligned}
&\frac{\mathrm{d}\Gamma}{\mathrm{d}\cos\theta_0\ \mathrm{d}\cos\theta_1\ \mathrm{d}\cos\theta_2\ \mathrm{d}\phi_1\ \mathrm{d}\phi_2} \\
&\propto 1+\alpha_0\cos^2\theta_0 \\
&+\sqrt{1-\alpha_0^2}\alpha_{p\pi^-}\sin\theta_0\cos\theta_0\sin\Delta\Phi\sin\theta_1\sin\phi_1\cos\theta_2 \\
&+\sqrt{1-\alpha_0^2}\alpha_{p\pi^-}\sin\theta_0\cos\theta_0\sin\Delta\Phi\cos\theta_1\sin\phi_1\sin\theta_2 \\
&\times\sqrt{1-\alpha_{\Lambda\pi^+}^2}\cos(\Delta_{\Lambda\pi^+}+\phi_2) \\
&+\sqrt{1-\alpha_0^2}\alpha_{p\pi^-}\sin\theta_0\cos\theta_0\sin\Delta\Phi\cos\phi_1\sin\theta_2 \\
&\times\sqrt{1-\alpha_{\Lambda\pi^+}^2}\sin(\Delta_{\Lambda\pi^+}+\phi_2) \\
&+\sqrt{1-\alpha_0^2}\alpha_{\Lambda\pi^+}\sin\theta_0\cos\theta_0\sin\Delta\Phi\sin\theta_1\sin\phi_1 \\
&+\alpha_0\alpha_{p\pi^-}\alpha_{\Lambda\pi^+}\cos^2\theta_0\cos\theta_2 \\
&+\alpha_{p\pi^-}\alpha_{\Lambda\pi^+}\cos\theta_2,
\end{aligned}
$$

Observation of the transverse polarization of Λ_c^+



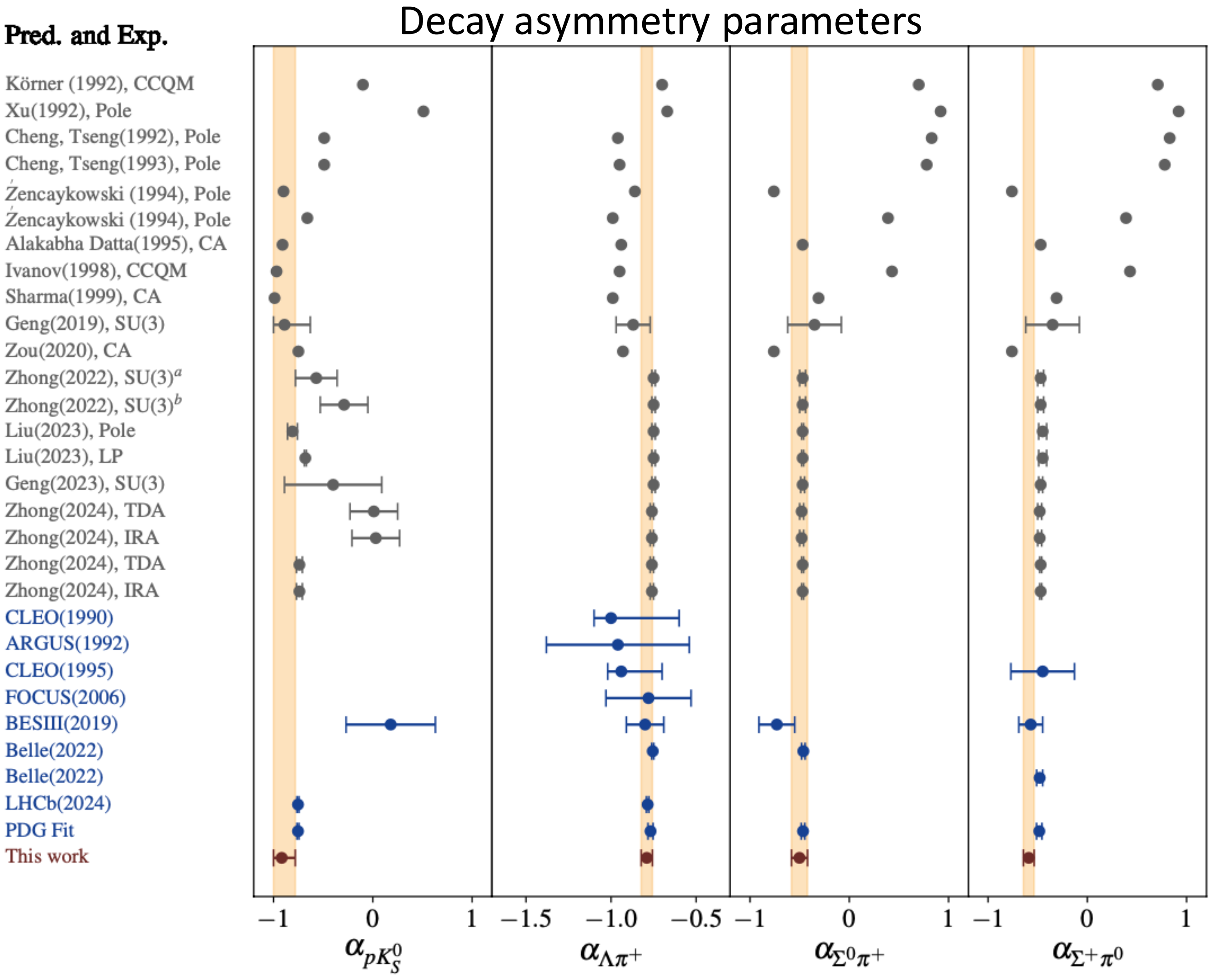
Fit of the joint angular distributions

2508.11400 (PRX Submitted)



The moment distribution to show the effect of transverse polarization

Observation of the transverse polarization of Λ_c^+



2508.11400 (PRX Submitted)

- The value of α_{pK_S} is now consistent with most theoretical calculations.
- The $\alpha_{\Sigma^0\pi^+}$ and $\alpha_{\Sigma^+\pi^0}$ support the prediction under SU(3) flavor symmetry.
- $\alpha_{\Sigma^+\pi^0}$ is more than 2σ different than the measurements from Belle.
- The result contributing to our understanding of its production properties.

Coming soon stay tunned

- Λ_c^+ semi-leptonic decays
- $\Lambda_c^+ \to p\pi^- e^+\nu_e$
- $\Lambda_c^+ \to \Sigma^\pm\pi^\mp e^+\nu_e$
- Λ_c^+ hadronic decays
- Absolute measurements of hadronic branching fractions of Λ_c^+ baryon
- $\Lambda_c^+ \to pK^+K^-$ (PWA)
- $\Lambda_c^+ \to pK^-\pi^+$ (PWA)
- $\Lambda_c^+ \to pK_S\pi^0$ (PWA)
- $\Lambda_c^+ \to nK_S\pi^+$ (PWA)
- $\Lambda_c^+ \to p\pi^+\pi^-$ (PWA)
- $\Lambda_c^+ \to \Sigma^+\pi^+\pi^-$ (PWA)
- $\Lambda_c^+ \to \Sigma^-\pi^+\pi^+$ (PWA)
- $\Lambda_c^+ \to n\pi^+\eta$ (Deep Learning)
- $\Lambda_c^+ \to p\eta'$ (Deep Learning)
- $\Lambda_c^+ \to p\pi^+\pi^-\pi^0$(Deep Learning)
- $\Lambda_c^+ \to \Sigma^0 K_S\pi^+$and $\Lambda_c^+ \to \Sigma^0 K_S K^+$with ST method
- $\Lambda_c^+ \to \Sigma^0\pi^+\pi^-\pi^+, \Sigma^0\pi^+\pi^-\pi^+\pi^0, \Lambda\pi^+\pi^0\pi^0$
- Λ_c^+ inclusive decay
- $\Lambda_c^+ \to \Lambda X$

Summary

- Recent results on Λ_c^+ SL and hadronic decays at BESIII are reported.
- These measurements provide important inputs for understanding the decay property of charmed baryons.
- BESIII collected approximately 6.4 fb^{-1} threshold data. More results of Λ_c^+ will be reported in the future.
- An upgrade of BEPCII (BEPCII-U) has been approved in July 2021:
  The optimized energy is 2.35 GeV with luminosity 3 times higher than current BEPCII and extend the maximum center-of-mass energy to 5.6 GeV.

Energy thresholds

✓	$\Lambda_c^+\bar{\Sigma}_c^-$	4.74 GeV
✓	$\Lambda_c^+\bar{\Sigma}_c\ \pi$	4.88 GeV
✓	$\Sigma_c\ \bar{\Sigma}_c$	4.91 GeV
✓	$\Xi_c\ \bar{\Xi}_c$	4.95 GeV
✓	$\Omega_c^0\bar{\Omega}_c^0$	5.4 GeV

Thanks for your attention!