

Recent results of hadron spectroscopy at LHCb

Chen Chen

University of Warwick, United Kingdom

On behalf of the LHCb Collaboration

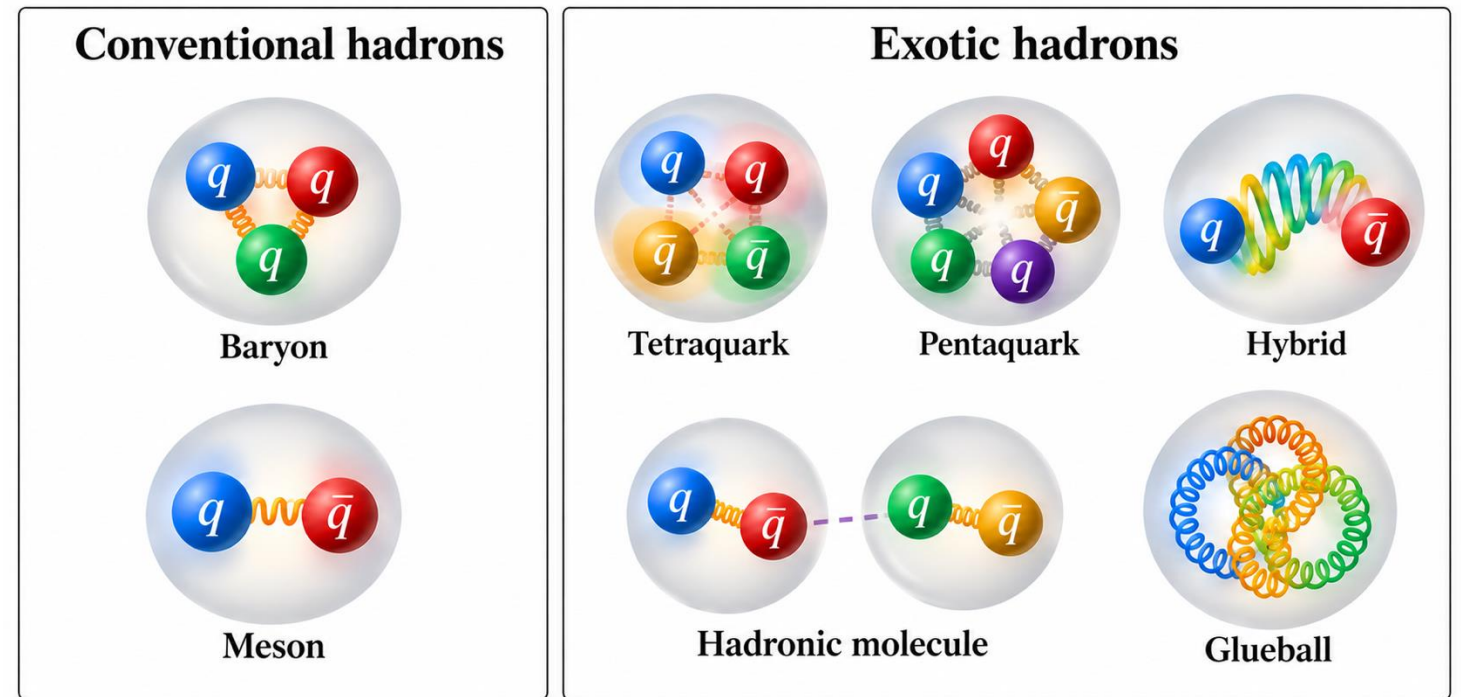
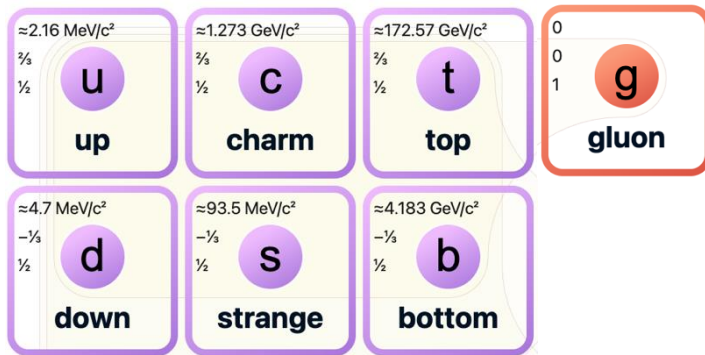
1st October 2026

QCD@LHC 2026

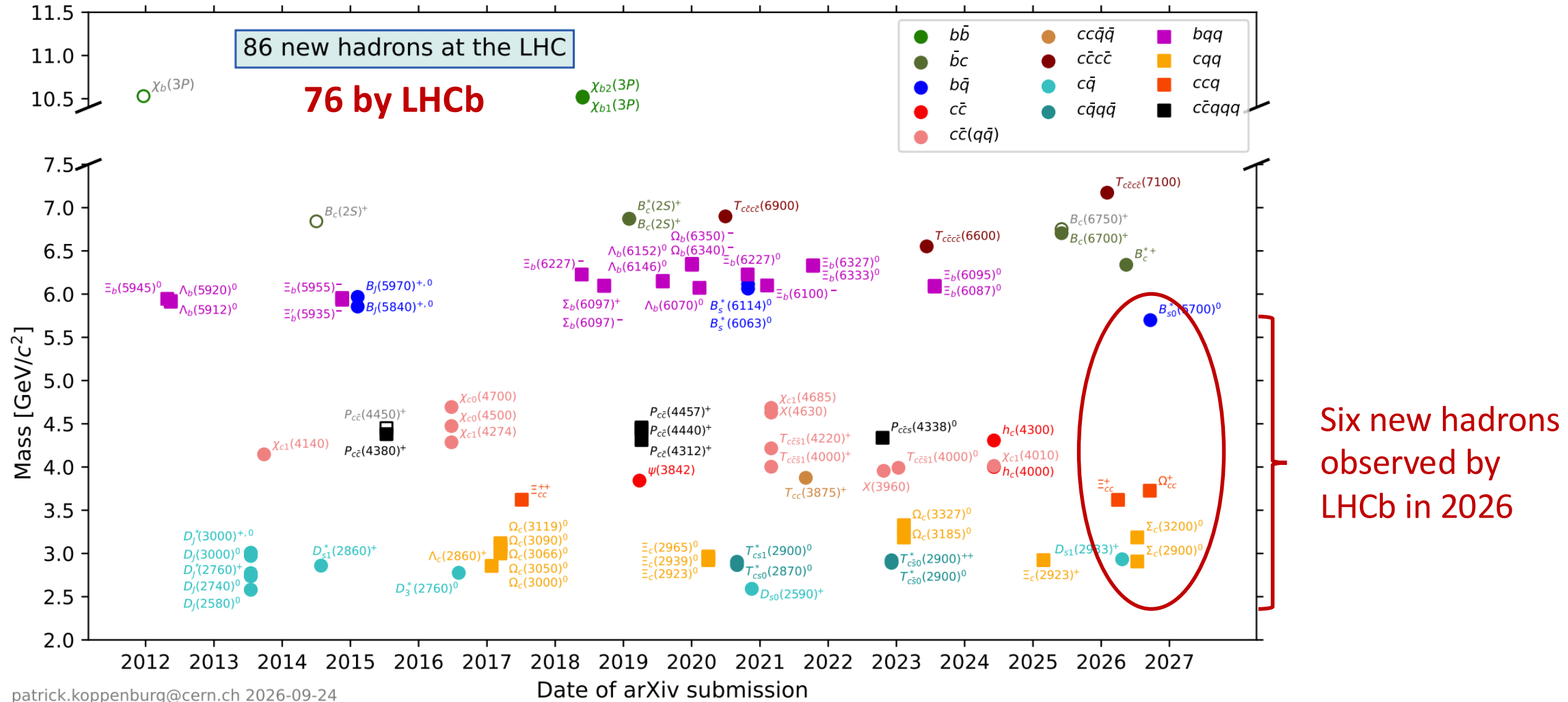
Oxford, United Kingdom

Introduction

- Hadrons exhibit a rich spectrum of quark flavours, inner structures and excitation patterns
- Important platform to study strong interaction at low-energy scales

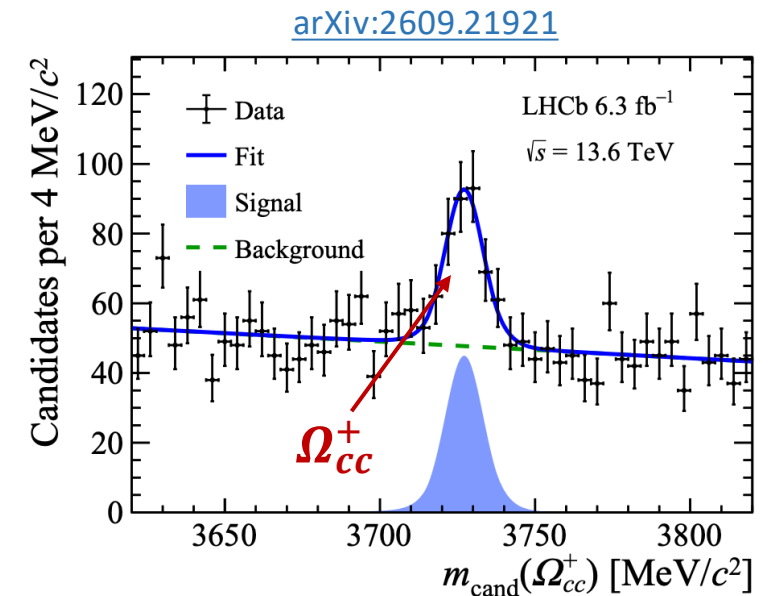
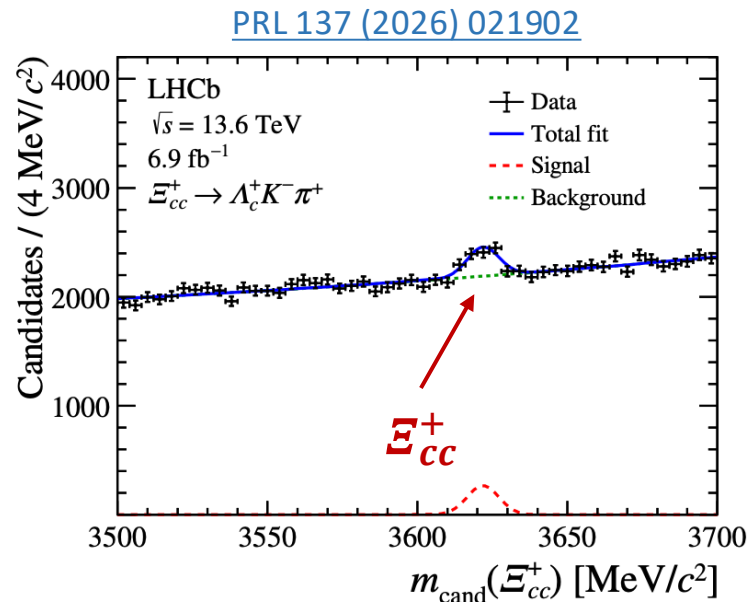
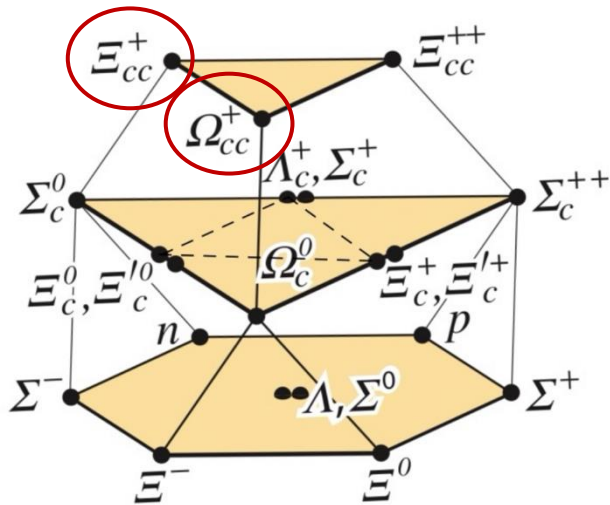
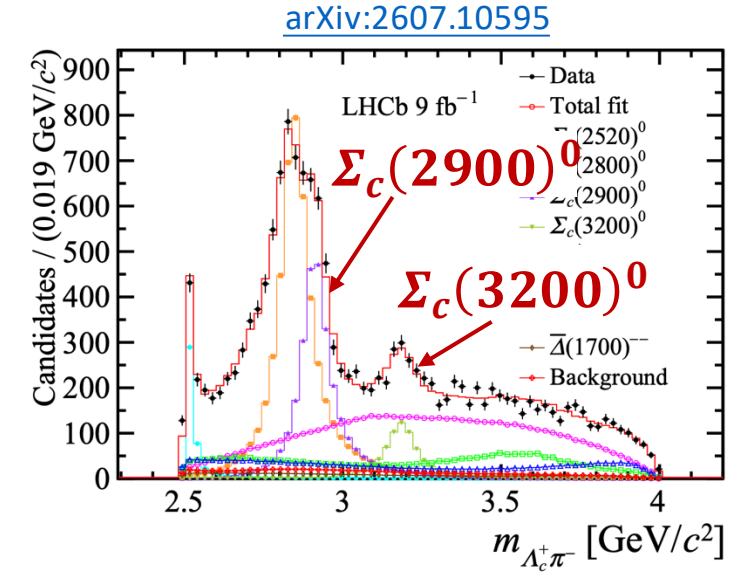
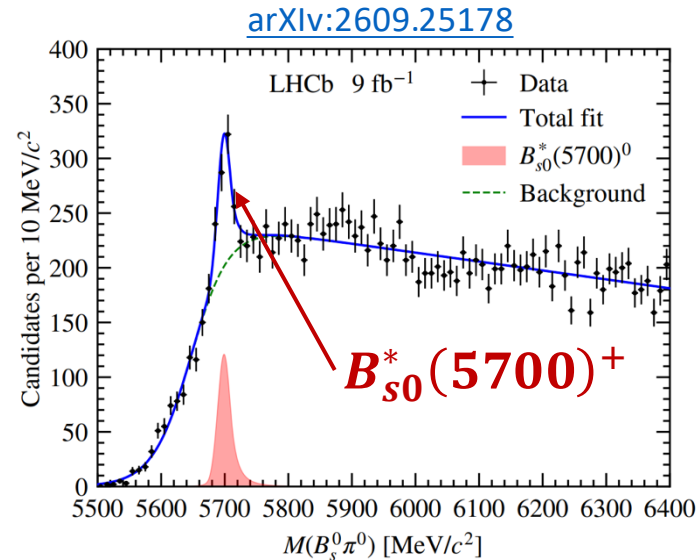
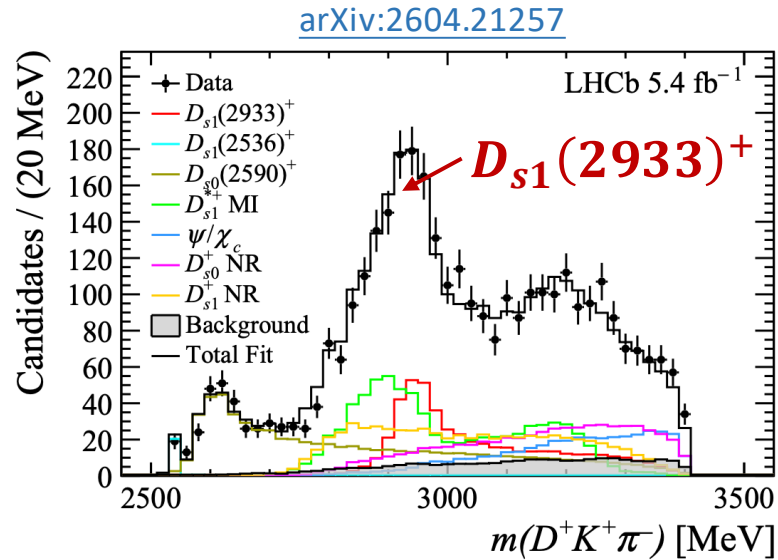


LHCb as a hadron factory



[Patrick's webpage]

Six new hadrons observed by LHCb in 2026



Selected topics

- Hidden-charm tetraquark

- New decay: $T_{c\bar{c}1}(4430)^- \rightarrow D^{*-} D^0$

LHCb-PAPER-2026-033
in preparation

- Charm-strange mesons

- Study of $D_{s1}(2460)^+ / D_{s1}(2536)^+ \rightarrow D_s^+ \pi^+ \pi^-$ decays
- New state: $D_{s1}(2933)^+$

[arXiv: 2604.21257](https://arxiv.org/abs/2604.21257)

[arXiv:2609.25178](https://arxiv.org/abs/2609.25178)

- Beauty-strange meson

- New state: $B_{s0}^*(5700)^0$

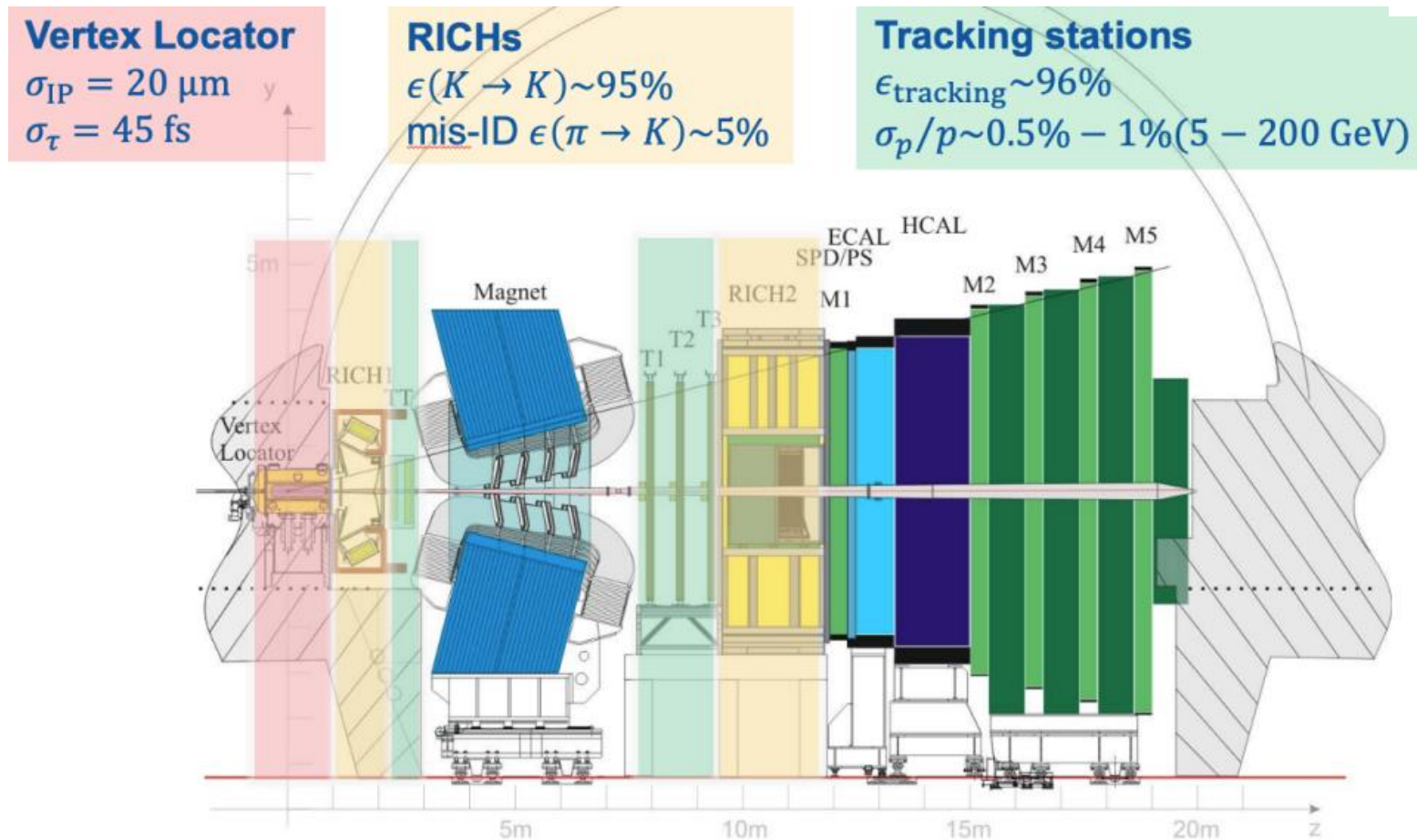
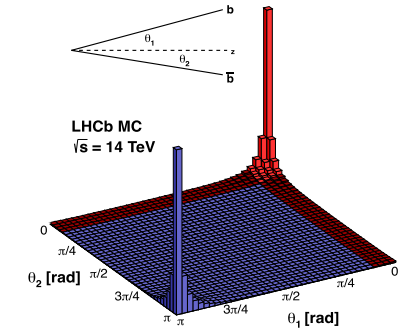
[arXiv: 2608.10826](https://arxiv.org/abs/2608.10826)

More seen in [Jibo's talk](#) on Wednesday

LHCb detector (Run1-2)

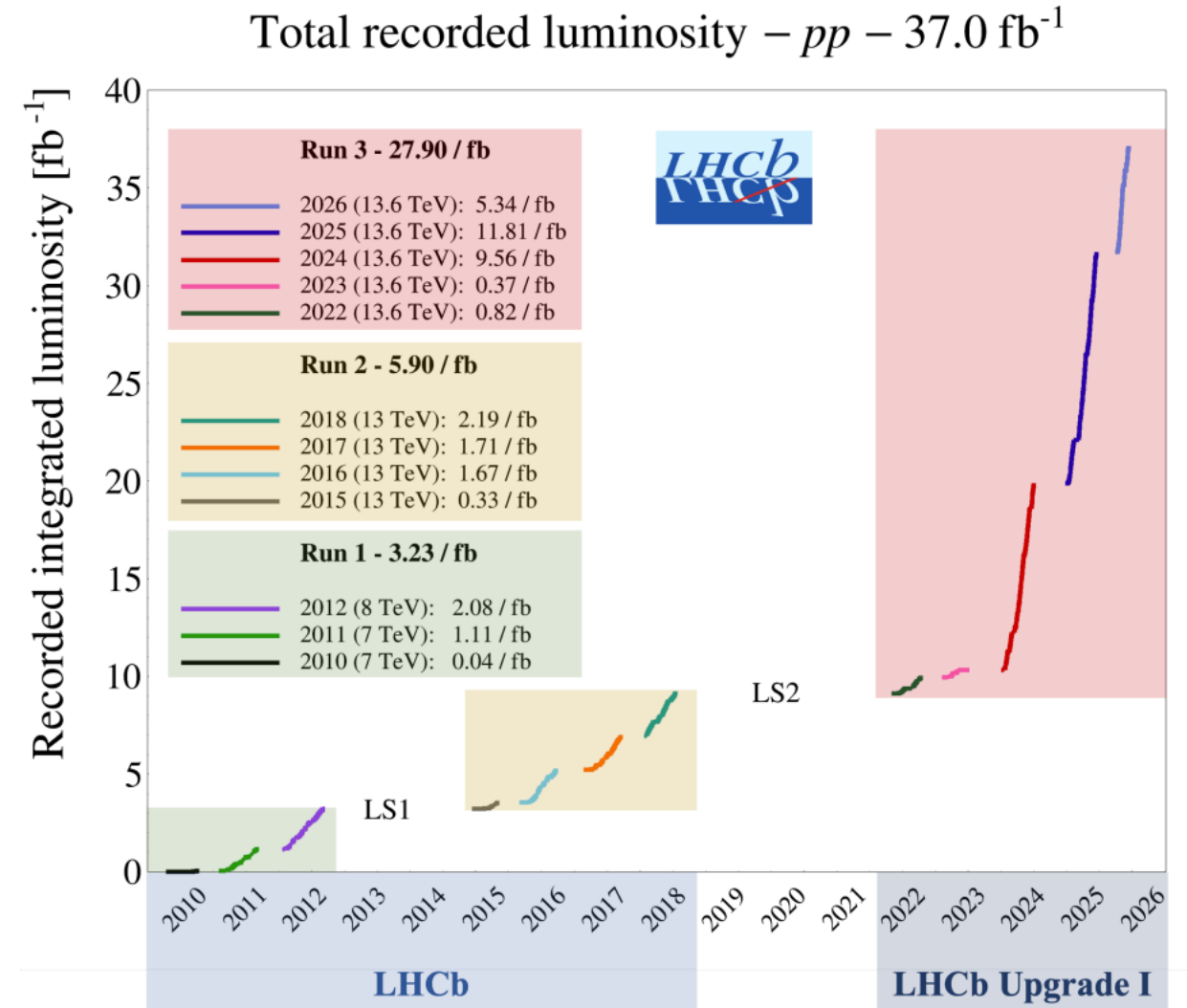
- Optimised for reconstructing heavy hadrons

$2 < \eta < 5$ range:
~25% $b\bar{b}$ pairs in
LHCb acceptance



LHCb dataset

- Total integrated luminosity: 37 fb^{-1}
- Much faster data accumulation in Run 3
 - $5 \times \mathcal{L}(t)$ with fresh-new detector
 - Fully software-based trigger
 - $\times 2$ hadronic trigger efficiency

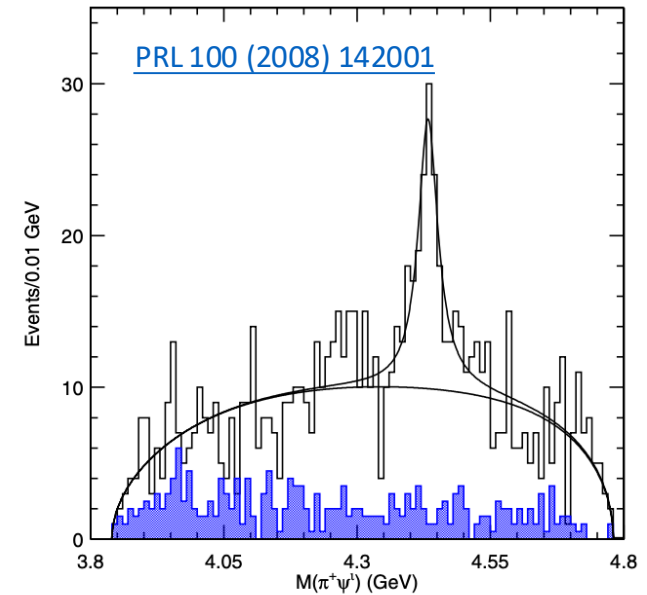


New decay: $T_{c\bar{c}1}(4430)^- \rightarrow D^{*-} D^0$

$T_{c\bar{c}1}(4430)^-$ Formerly $Z_c(4430)$

- First observed in $B^0 \rightarrow \psi(2S)\pi^- K^+$ by Belle in 2008
 - Spin-parity later determined as $J^P = 1^+$
- Confirmed by LHCb in $\psi(2S)\pi^-$ of several decays
 - $B^0 \rightarrow \psi(2S)\pi^- K^+$; $B^+ \rightarrow \psi(2S)\pi^- \pi^+ K^+ \pi^+$; $B^- \rightarrow \psi(2S)\pi^- K_S^0$

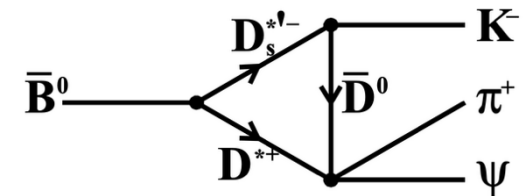
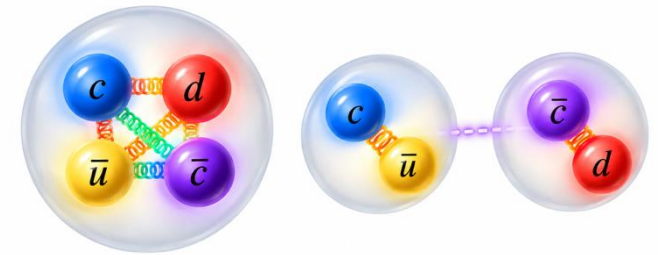
[PRL 112 \(2014\) 222002](#), [JHEP 01 \(2025\) 054](#), [PRD 113 \(2026\) L071101](#)



• Discussions about $T_{c\bar{c}1}(4430)^-$

- Manifestly exotic states of four quarks
- **Structure remains unknown**
 - $D^*\bar{D}_1$ molecular? [PRD 77 \(2008\) 094015](#)
 - Compact tetraquark? [PRD 89 \(2014\) 114010](#)
 - Triangle singularity involving open-charm final states?

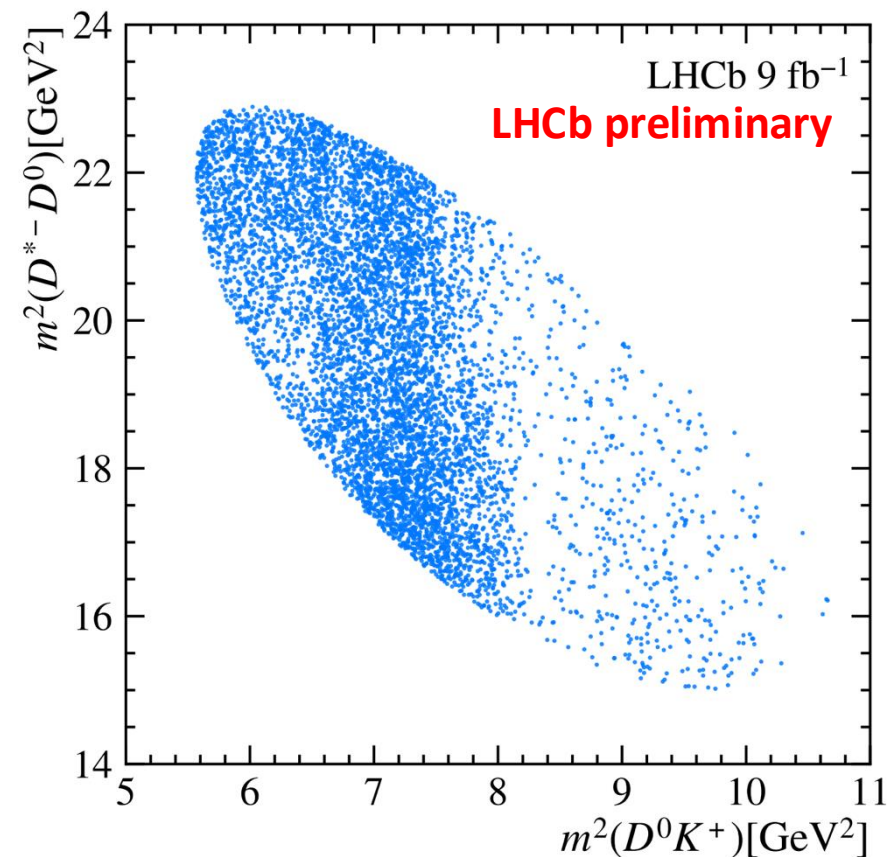
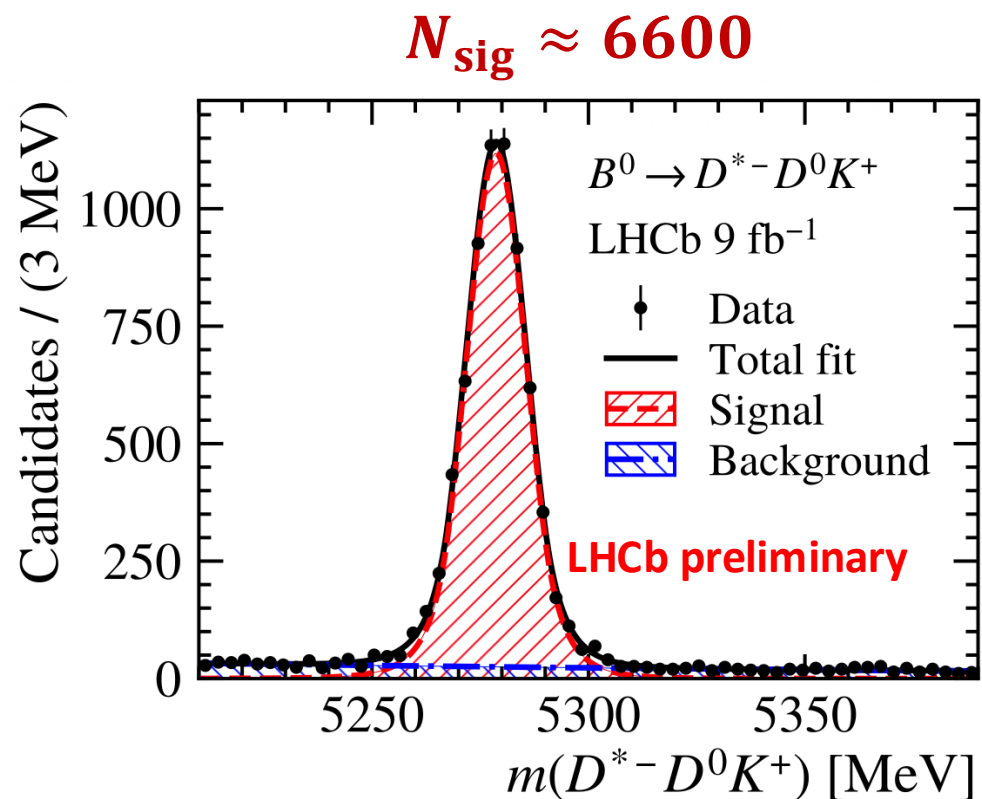
[PLB 702 \(2011\) 139](#)



Search for $T_{c\bar{c}1}(4430)^-$ in open-charm final state?

$B^0 \rightarrow D^{*-} D^0 K^+$ decays

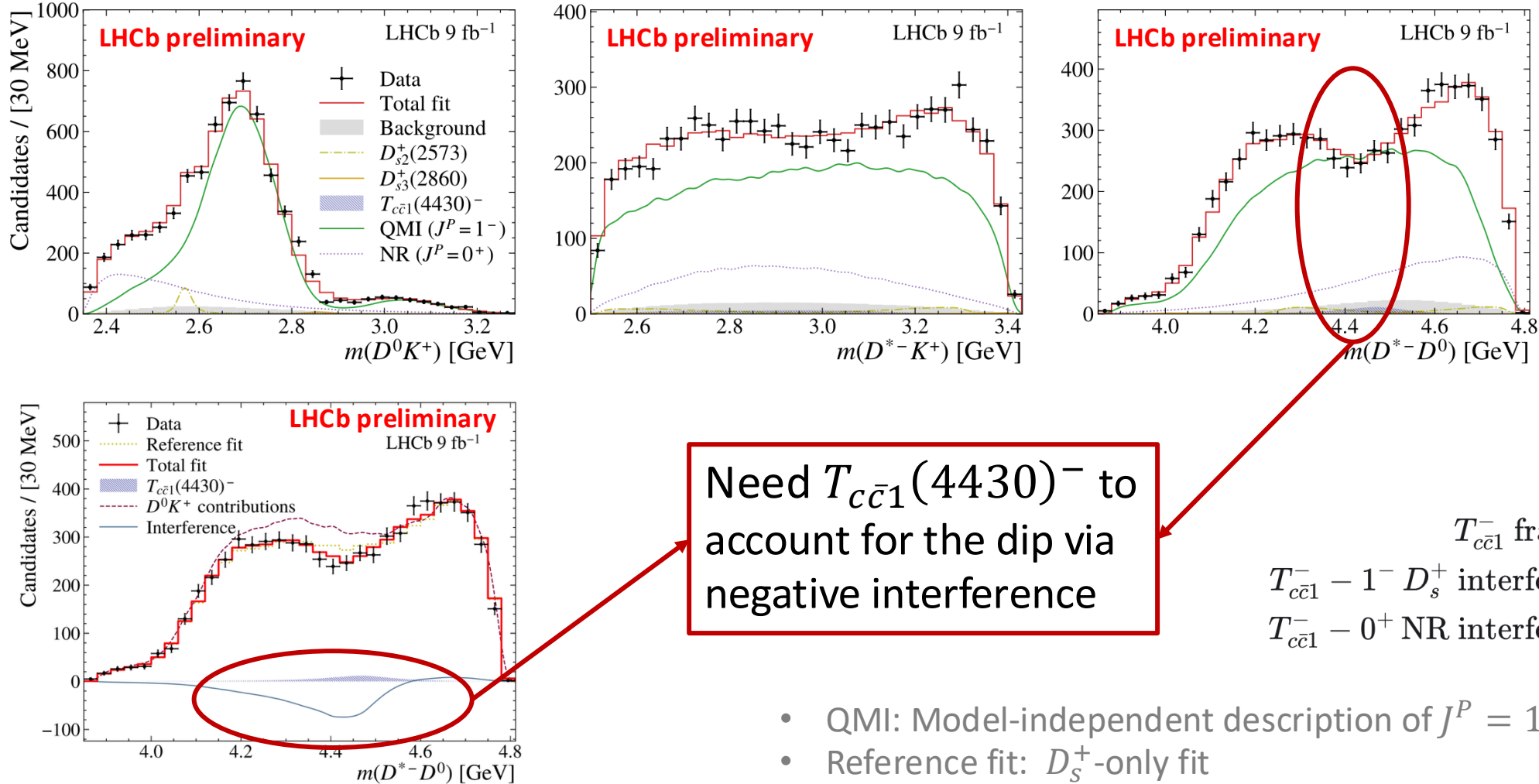
- Run 1+2 data



$$T_{c\bar{c}1}(4430)^- \rightarrow D^{*-} D^0$$

- Amplitude analysis of $B^0 \rightarrow D^{*-} D^0 K^+$
 - Only $D_s^{**+} \rightarrow D^0 K^+$ contributions can not well describe the data

No evidence of other $T_{c\bar{c}}$ states or $T_{c\bar{s}} \rightarrow D^{*-} K^+$



- QMI: Model-independent description of $J^P = 1^- D_s^+$ resonances
- Reference fit: D_s^+ -only fit

$T_{c\bar{c}1}(4430)^-$ properties

$$\left. \begin{aligned} M_0 &= 4424_{-6}^{+12} \pm 21 \text{ MeV} \\ \Gamma_0 &= 145 \pm 39 \pm 17 \text{ MeV} \\ J^P &= 1^+ \end{aligned} \right\} \text{Compatible with PDG values}$$

$$\mathcal{B}(B^0 \rightarrow T_{c\bar{c}1}(\rightarrow D^{*-} D^0) K^+) = (3.28 \pm 0.99_{-1.58}^{+0.71} \pm 0.28) \times 10^{-5}$$

$$\frac{\Gamma(T_{c\bar{c}1} \rightarrow D^{*-} D^0)}{\Gamma(T_{c\bar{c}1} \rightarrow \psi(2S) \pi^-)} = 0.96 \pm 0.29_{-0.48-0.57}^{+0.22+0.30}$$

Comparable couplings to open-charm and hidden-charm final states disfavour a pure $D^* \bar{D}_1$ molecular interpretation

Uncertainties are statistical, systematic and external, respectively

Charm-strange mesons

Low mass puzzles in D_s^+ spectrum

- Two states observed in 2003
 - $D_{s0}^*(2317)^+$: below DK threshold
 - $D_{s1}(2460)^+$: below D^*K threshold

Masses significantly lower than quark-model predictions

Tetraquark? [arXiv:2602.11744](https://arxiv.org/abs/2602.11744)

Couple channel effect?

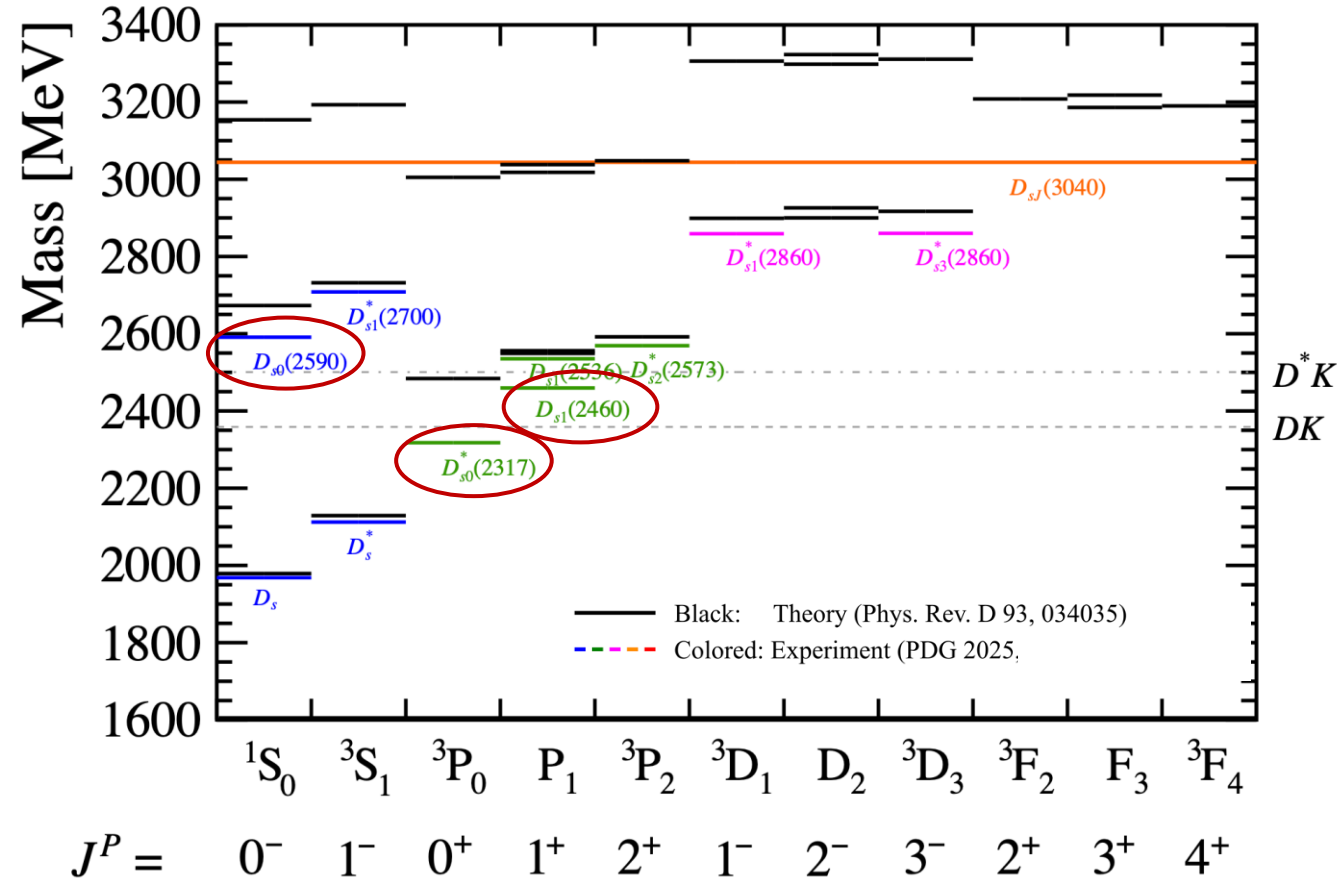
[PRD 106 \(2022\) 074014](https://arxiv.org/abs/2207.07401)

- $D_{s0}(2590)^+$ observed in 2021

Mass also lower than quark-model prediction

Couple channel effect?

[PRD 106 \(2022\) 074014](https://arxiv.org/abs/2207.07401)



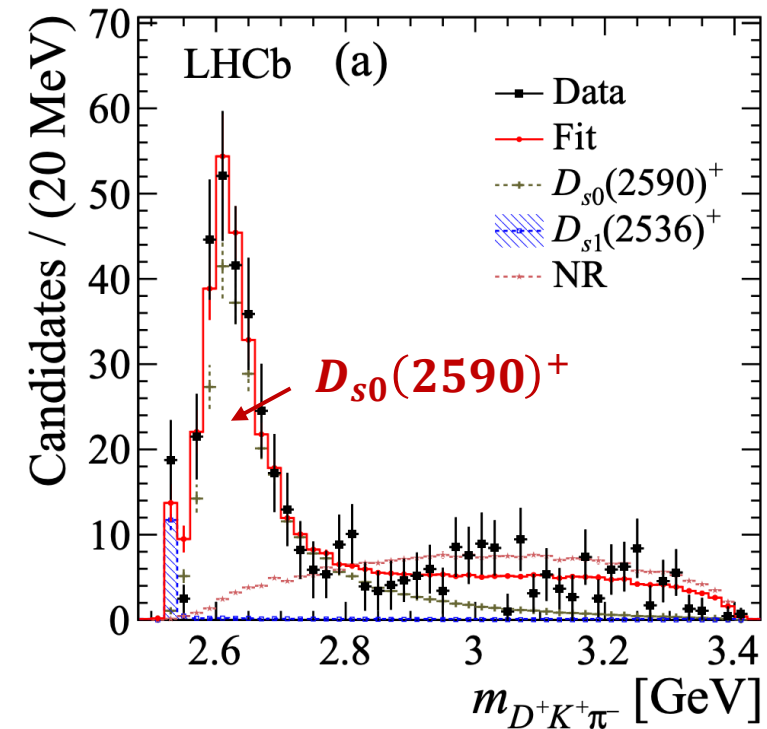
- ✓ Complete the D_s^+ spectrum
- ✓ Study decays of these states

New D_s^+ state

$D^+ K^+ \pi^-$ system of $B^0 \rightarrow D^+ D^- K^+ \pi^-$

- D_s^+ states in $D^+ K^+ \pi^-$ 3-body final state
 - Complementary to the extensively studied $D^{(*)} K$ 2-body systems
 - Rich excitation pattern: access to all spin-parity except for 0^+
- In 2021, LHCb observed $D_{s0}(2590)^+$
 - Limited phase space: $m(K^+ \pi^-) < 0.75$ GeV
 - Candidate for $D_s(2^1 S_0)^+$

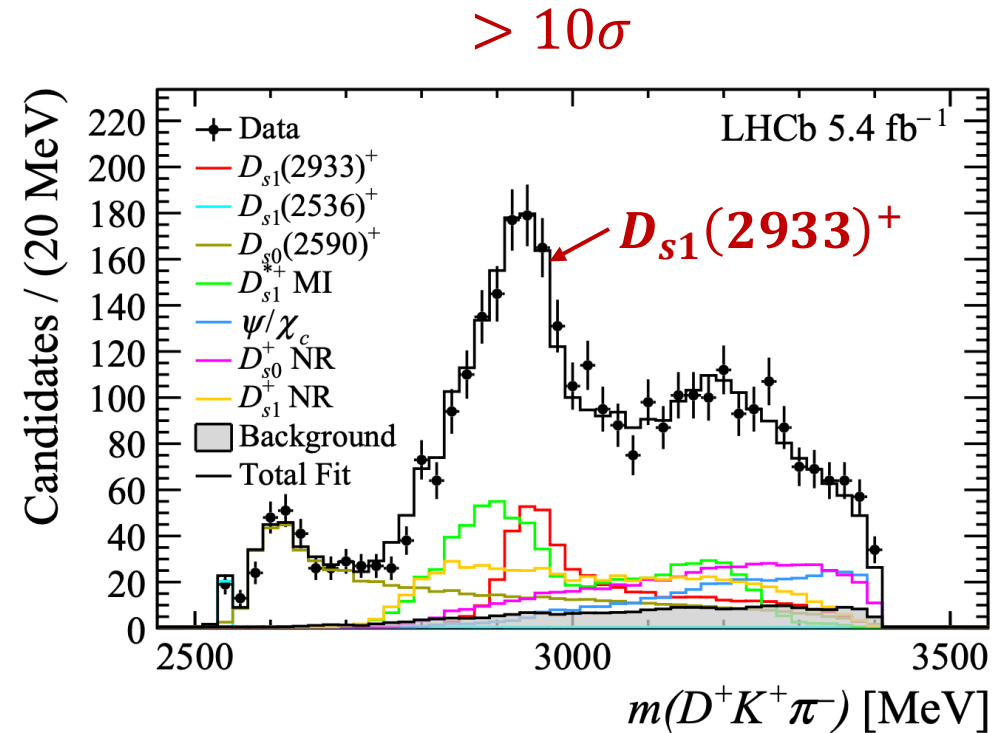
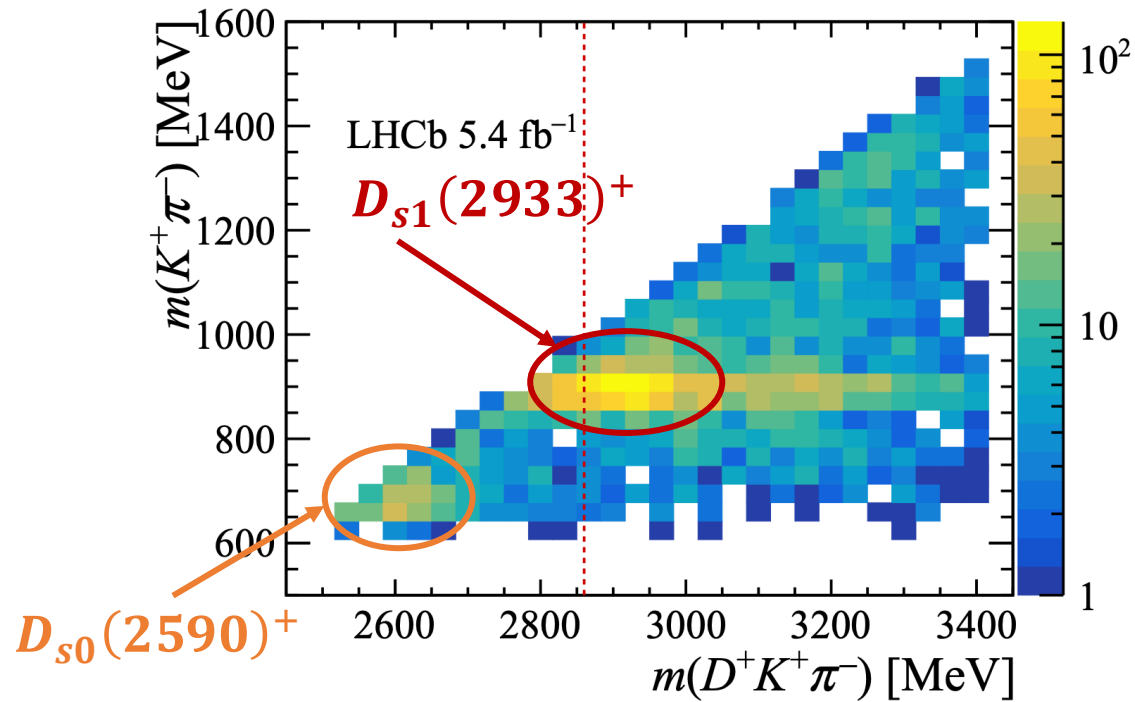
Higher excitations in full phase space?



[PRL 126 \(2021\) 122002](#)

New state: $D_{s1}(2933)^+$

- Amplitude analysis of $B^0 \rightarrow D^+ D^- K^+ \pi^-$ in the full phase space
- Run2 data
- B^0 yield: ~ 3265



- D_{s1}^+ MI: model-independent description of $J^P = 1^-$ D_s^+
- ψ/χ_c : charmonia in $D^+ D^-$

$D_{s1}(2933)^+$ in the D_s^+ spectrum

$$m_0 = 2933_{-5}^{+6} (\text{stat})_{-3}^{+4} (\text{syst}) \text{ MeV}$$

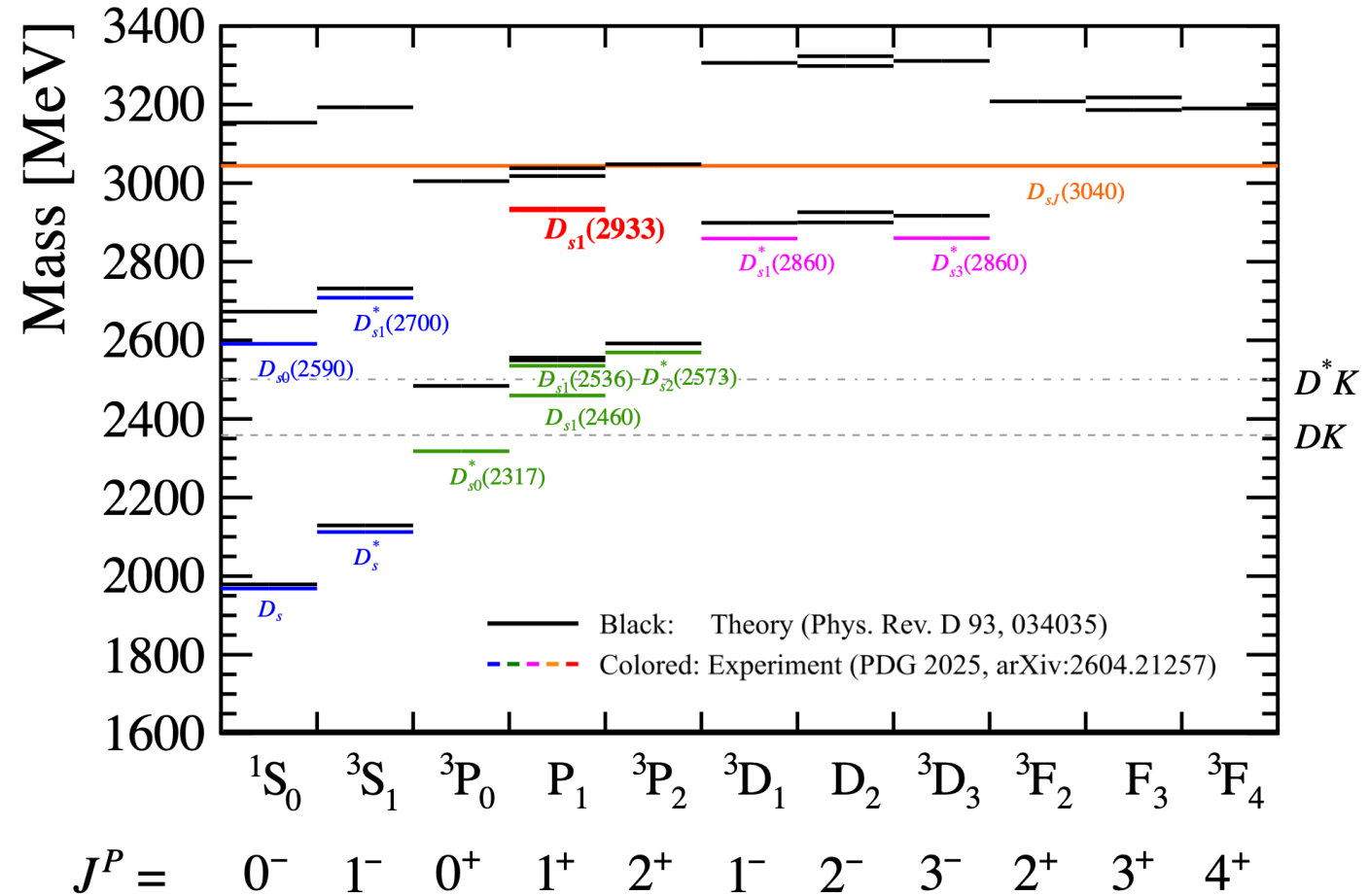
$$\Gamma_0 = 72_{-12}^{+18} (\text{stat})_{-10}^{+7} (\text{syst}) \text{ MeV}$$

$$J^P = 1^+$$

- Radial excitation of $D_{s1}(2460)^+ / D_{s1}(2536)^+$
- Mass also lower than quark-model prediction
 - Similar pattern as $D_{s0}(2590)^+$

Couple channel effect?

[arXiv:2605.17832](https://arxiv.org/abs/2605.17832)



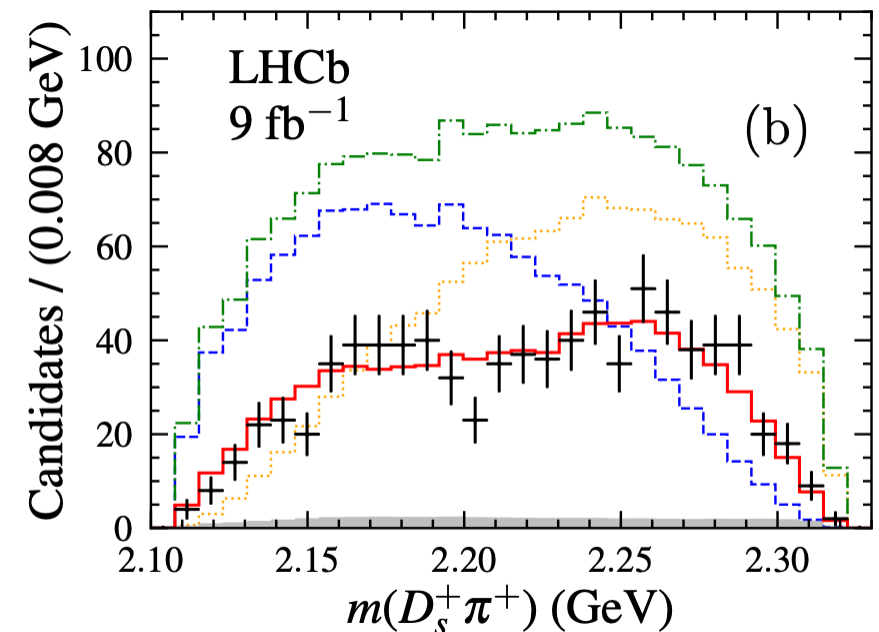
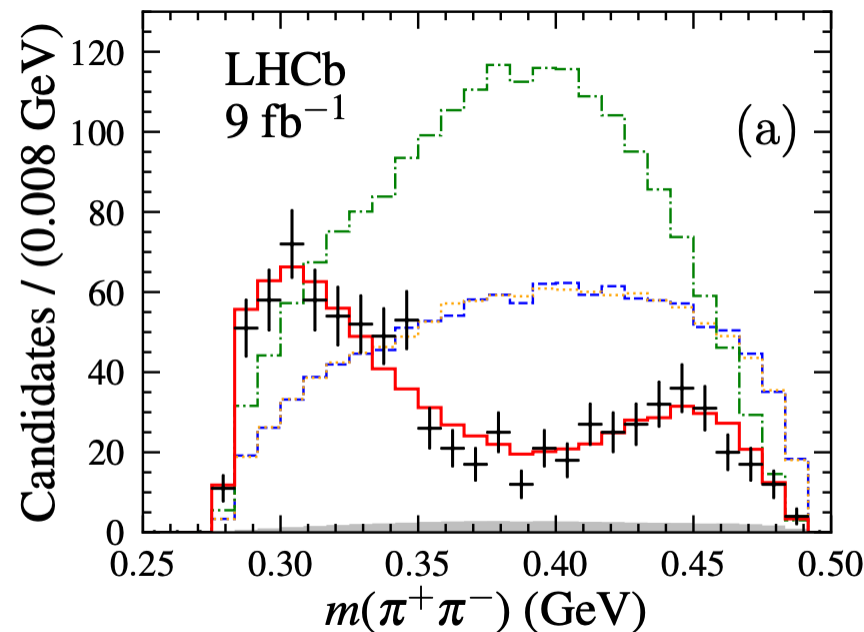
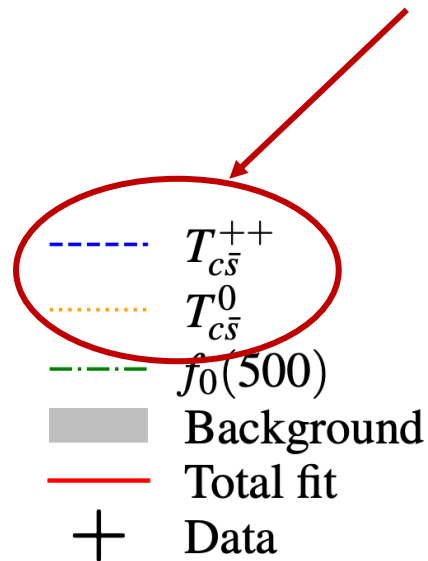
$$D_{s1}(2460)^+ / D_{s1}(2536)^+ \rightarrow D_s^+ \pi^+ \pi^-$$

2024 Study of $D_{s1}(2460)^+ \rightarrow D_s^+ \pi^+ \pi^-$

- Double-charm decays: $B \rightarrow \bar{D}^{(*)} D_s^+ \pi^+ \pi^-$

A natural description requires **two tetraquark states** with mass just above the $D_s^+ \pi^\pm$ upper mass boundary

To confirm in other decays??

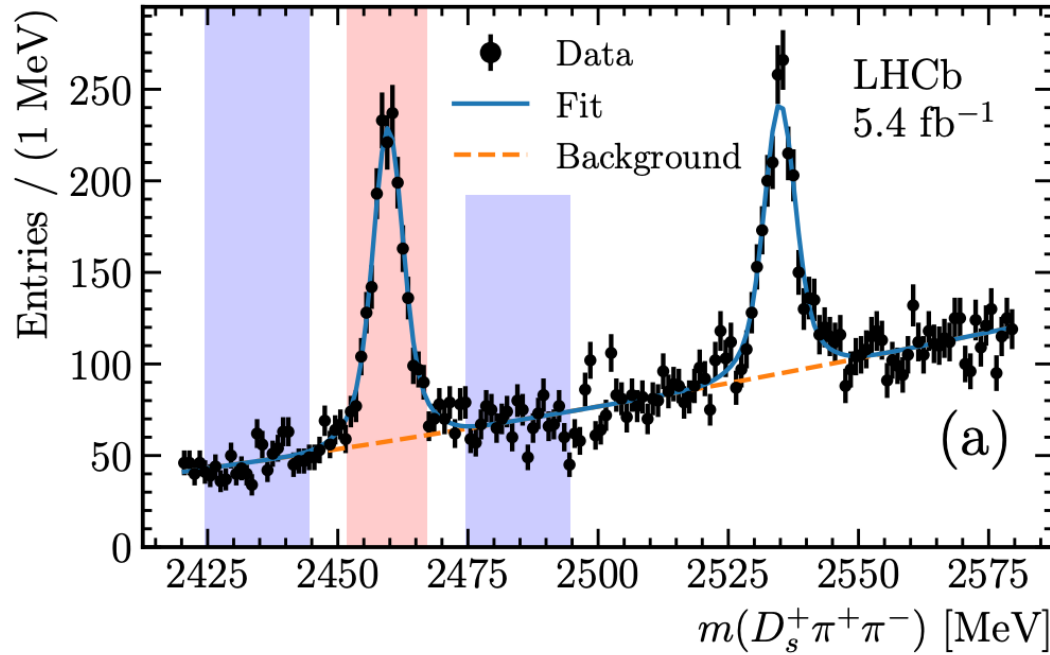


Muon-tagged $D_{s1}(2460)^+ / D_{s1}(2536)^+ \rightarrow D_s^+ \pi^+ \pi^-$

- $D_s^+ \pi^+ \pi^- \mu^-$:

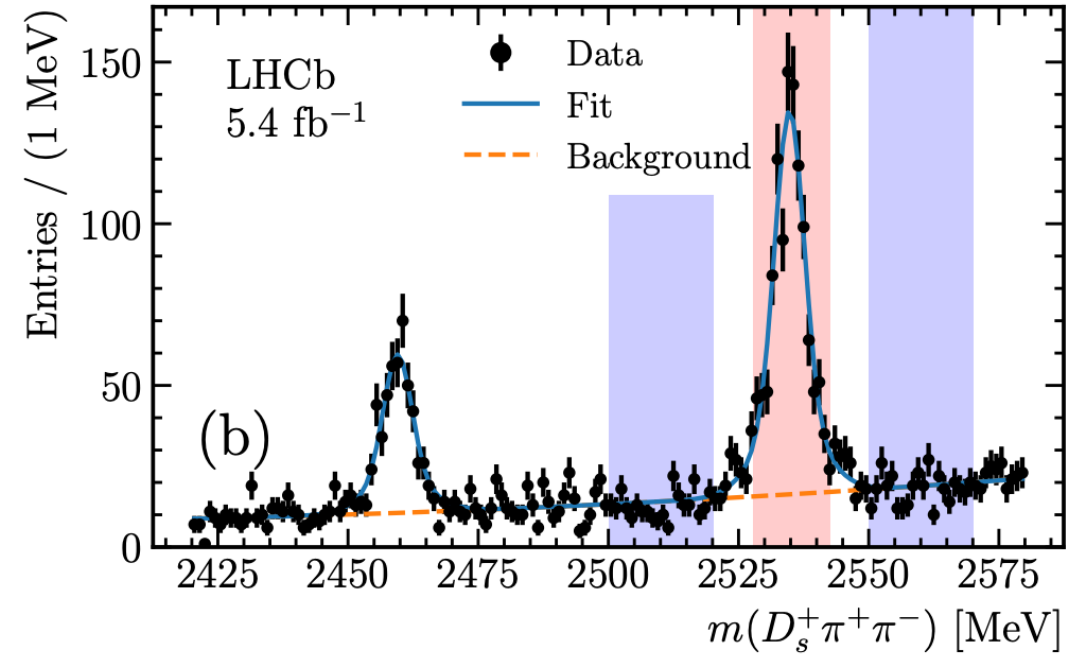
Double charm enhanced sample:

$$B \rightarrow D_s^+ \pi^+ \pi^- \bar{D} X, \bar{D} \rightarrow \mu^- X'$$



Semileptonic enhanced sample:

$$B \rightarrow D_s^+ \pi^+ \pi^- \mu^- X$$



Parameter	DD selection	SL selection
$D_{s1}(2460)^+$ yield	1360 ± 70	376 ± 25
$D_{s1}(2536)^+$ yield	1180 ± 60	980 ± 40

$D_{s1}(2460)^+ / D_{s1}(2536)^+ \rightarrow D_s^+ \pi^+ \pi^-$ Dalitz plot analysis

- Simultaneous fit to
 - $D_{s1}(2460)^+$ and $D_{s1}(2536)^+$ decays
 - Double charm and semileptonic enhanced samples

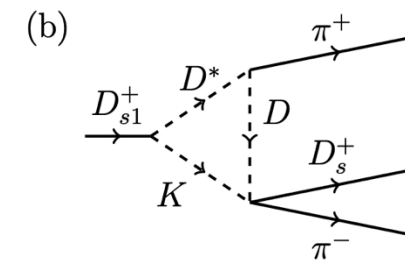
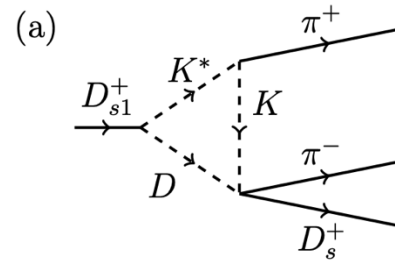
- Several models tested:

- $f \rightarrow \pi^+ \pi^-$ states only: $f_0(500)$, $f_0(980)$, $f_2(1270)$

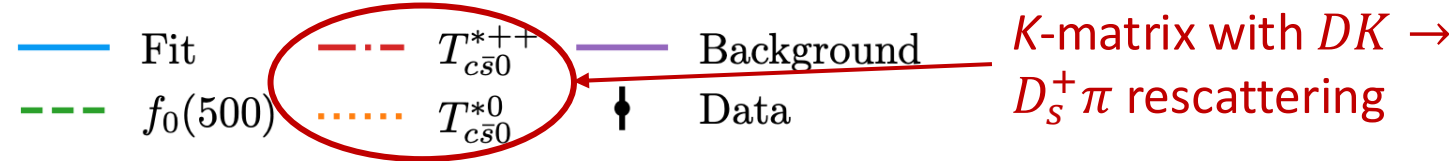
- f states + triangle diagrams

- f states + $T_{c\bar{s}0}^{++/0}$ (best fit)

- $T_{c\bar{s}0}^{++/0}$ modelled with relativistic Breit-Wigner function (parameters poorly determined)
 - $T_{c\bar{s}0}^{++/0}$ modelled with K-matrix considering $DK \rightarrow D_s^+ \pi$ rescattering (most reasonable)

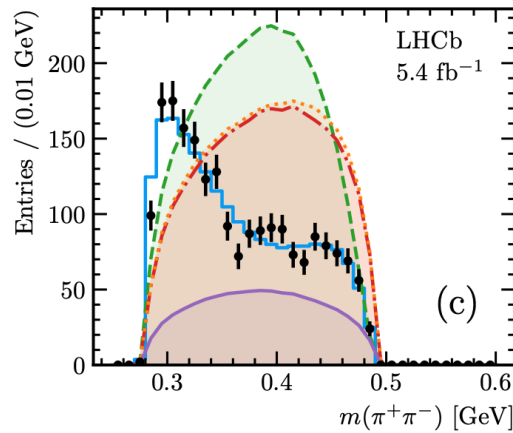
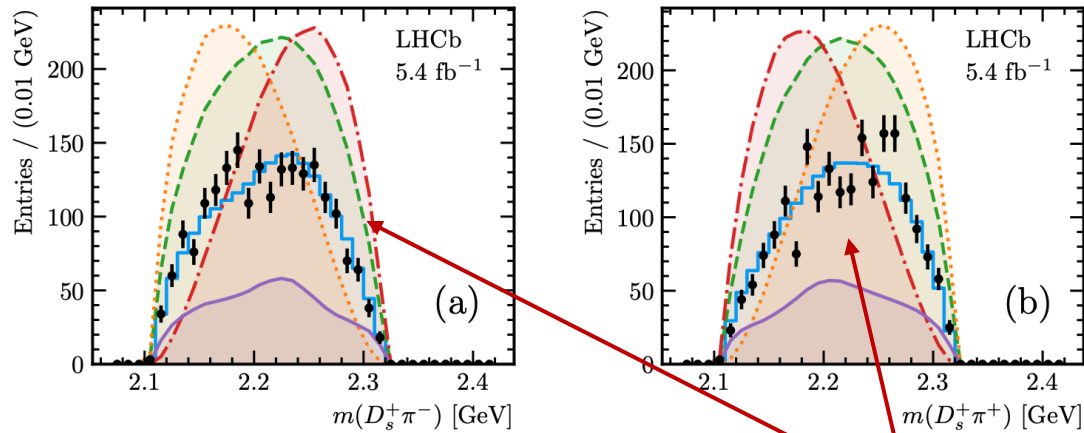


$D_{s1}(2460)^+ / D_{s1}(2536)^+ \rightarrow D_s^+ \pi^+ \pi^-$ Dalitz plot analysis



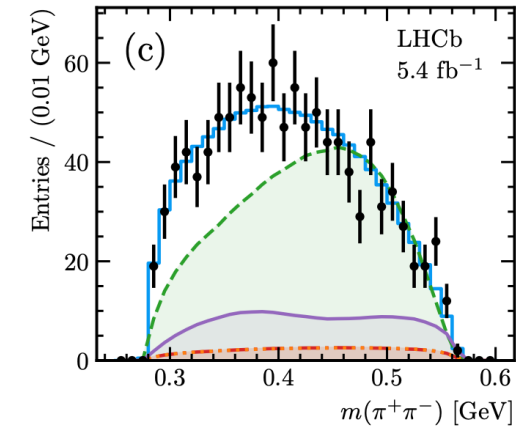
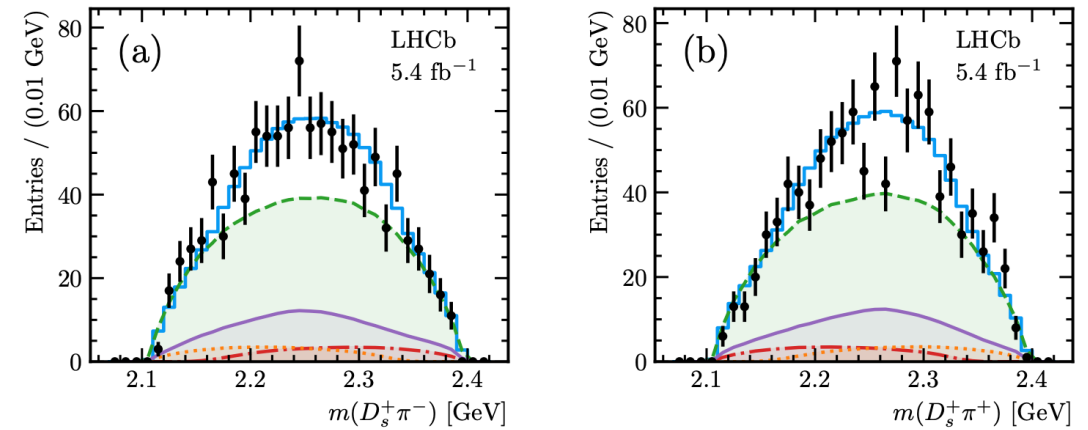
$D_{s1}(2460)^+$

$D_{s1}(2536)^+$



Significant contribution of $T_{c\bar{s}0}^*$ in $D_{s1}(2460)^+$ decay

Exotic nature of $D_{s1}(2460)^+$?

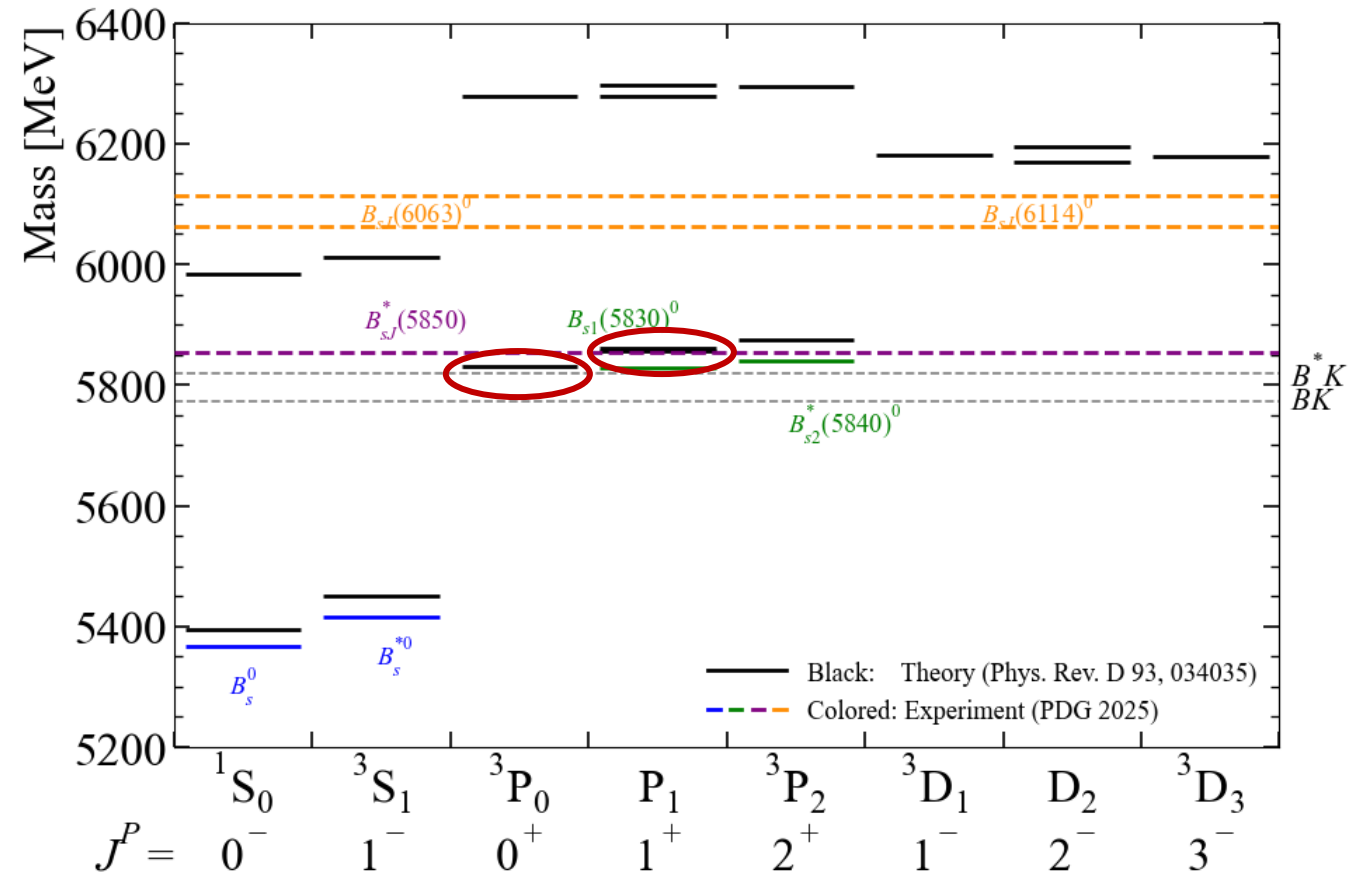


$T_{c\bar{s}0}^*$ in $D_{s1}(2536)^+$ decay: 4σ

Beauty-strange mesons

From D_s^+ to B_s^0 spectrum

- Where are the missing states?
- If $D_{s0}^*(2317)^+ / D_{s1}(2460)^+$ correspondences show unexpected low mass?



New state in the $B_s^0 \pi^0$ final state

- $B_s^0 \rightarrow D_s^- \pi^+, J/\psi \phi, D_s^- 3\pi^\pm$
- $\pi^0 \rightarrow 2\gamma$

- Two interpretations:

$$B_{s0}^* \rightarrow B_s^0 \pi^0 \quad m = 5698.9 \pm 1.5 \text{ (stat)} \pm 0.6 \text{ (syst)} \text{ MeV}$$

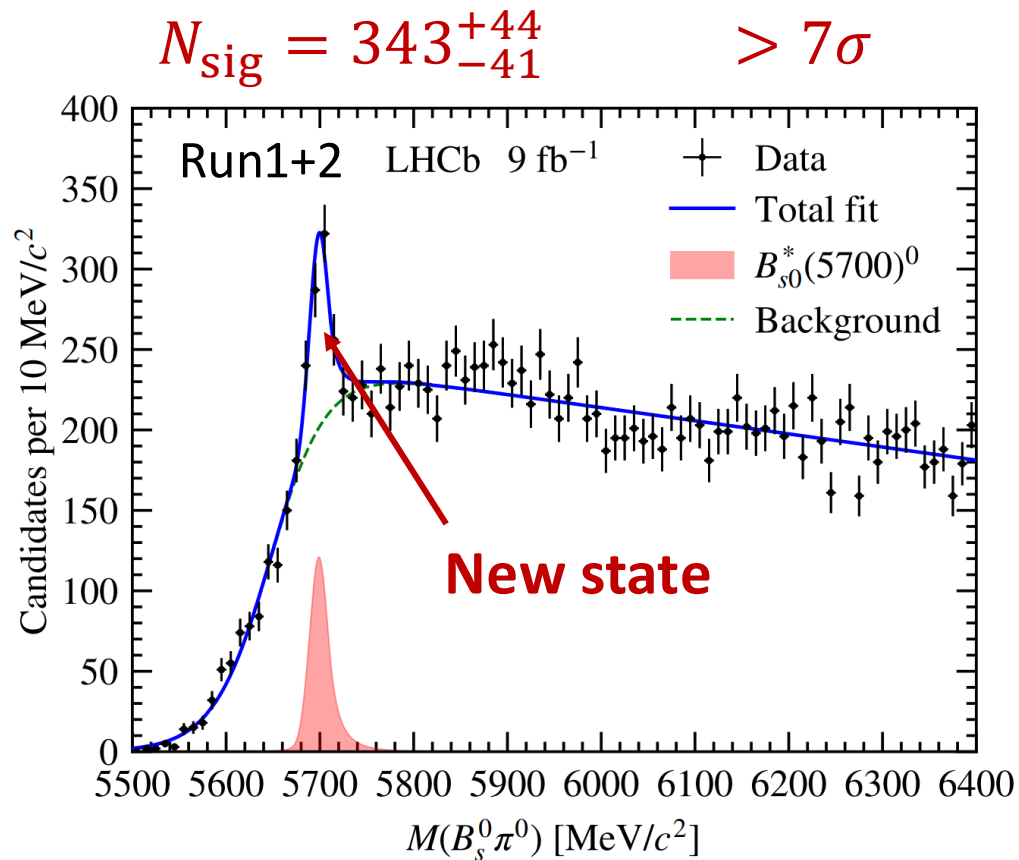
$$\Gamma < 11.8 \text{ MeV} \quad (95\% \text{ CL})$$

$$B_{s1} \rightarrow B_s^{*0} \pi^0 \quad m = 5748.3 \pm 1.5 \text{ (stat)} \pm 0.6 \text{ (syst)} \text{ MeV}$$

$$\Gamma < 11.8 \text{ MeV} \quad (95\% \text{ CL})$$

$$B_s^{*0} \rightarrow B_s^0 \gamma: \gamma \text{ missing}$$

Future study of $B_s^0 \gamma$ can access
both B_{s0}^* and B_{s1}



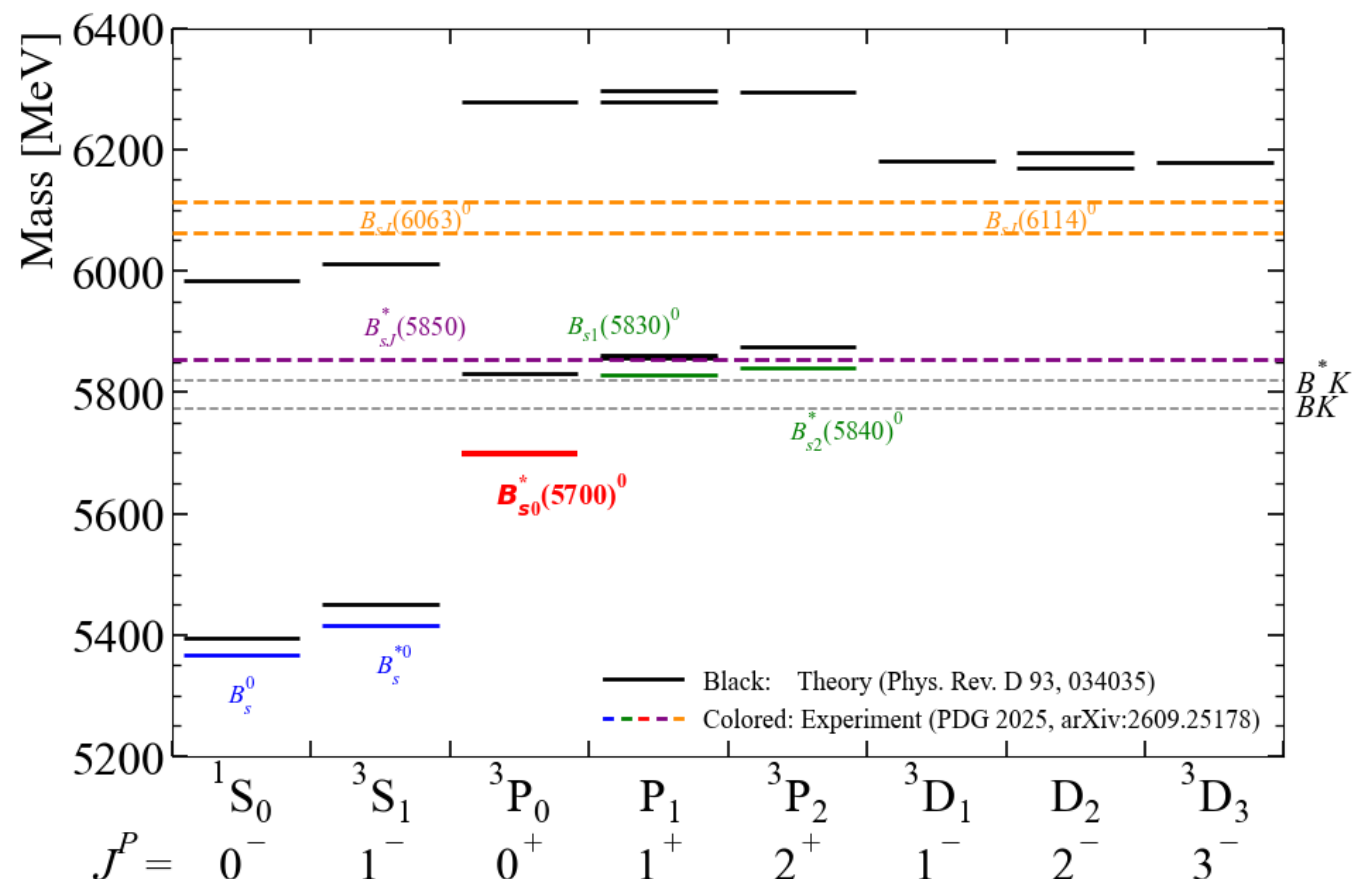
New state in the B_s^0 spectrum Under $J^P = 0^+$ interpretation

- Mass significantly lower than the quark-model prediction
- Similar mass splitting as $D_{s0}^*(2317)^+$
 - the same heavy-flavour independent mechanism?

$$m(D_{s0}^*(2317)) - m(D_s) = 349.5 \text{ MeV}$$

$$m(B_{s0}^*(5700)) - m(B_s) = 332.0 \text{ MeV}$$

Exotic nature?



Similar pattern to that of $D_{s1}(2460)^+$ under the $J^P = 1^+$ interpretation

Summary

- LHCb is a rich hadron factory at LHC: **six new hadrons observed in 2026**
- Results presented in this talk:

Hidden-charm tetraquark

- New decay: $T_{c\bar{c}1}(4430)^- \rightarrow D^{*-} D^0$

D_s^+ and B_s^+ spectra:

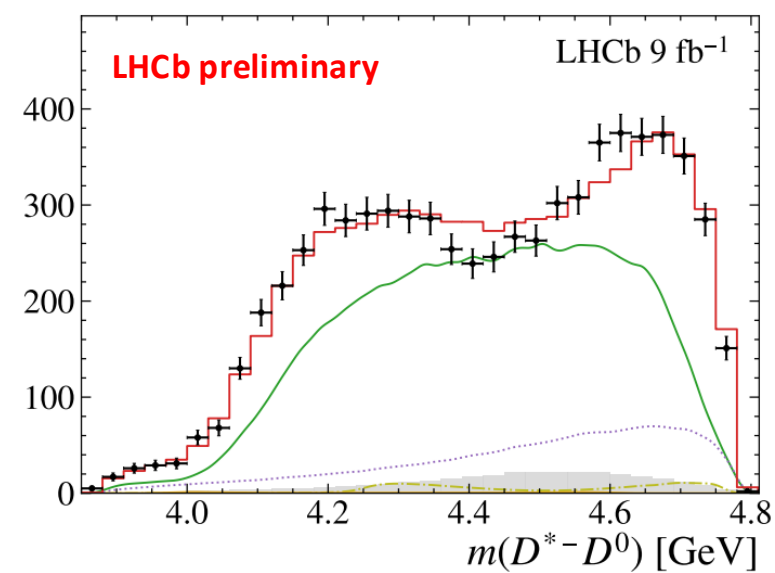
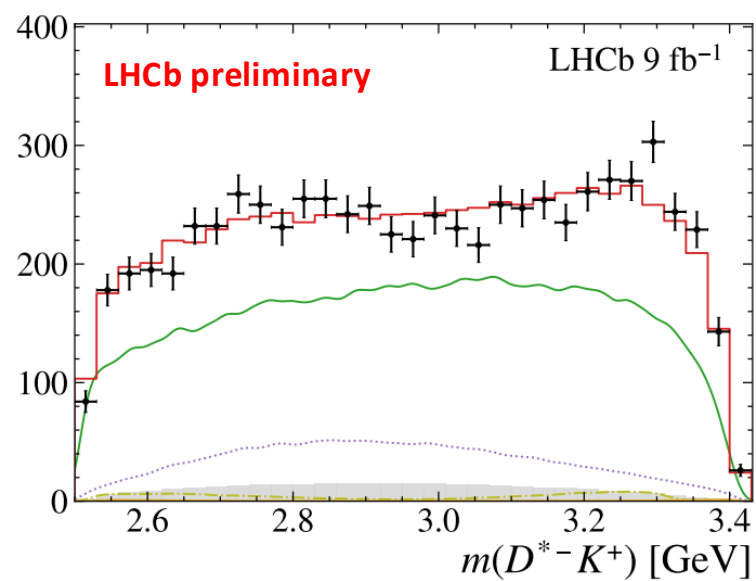
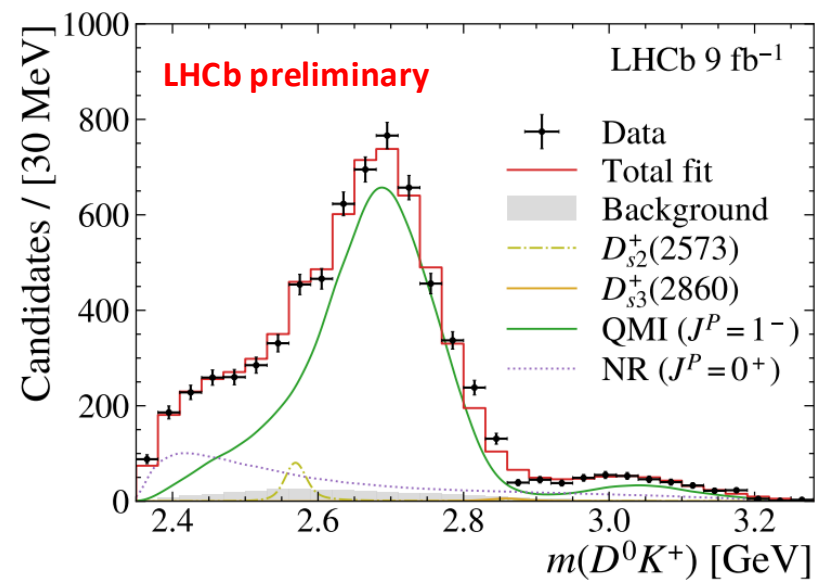
- New state: $D_{s1}(2933)^+$
- $D_{s1}(2460)^+ / D_{s1}(2536)^+ \rightarrow D_s^+ \pi^+ \pi^-$
- New state: $B_{s0}^*(5700)^0$

- Run3 opportunities (**$\times 8$ statistics for hadronic modes**)
 - Measure known hadrons in different final states
 - Many unobserved hadrons come within reach, in particular in the beauty and baryon sector

Stay tuned! Thanks for listening

Backup

$B^0 \rightarrow D^{*-} D^0 K^+$ fit without $T_{c\bar{c}1}(4430)^-$



$B^0 \rightarrow D^{*-} D^0 K^+$ fit fractions

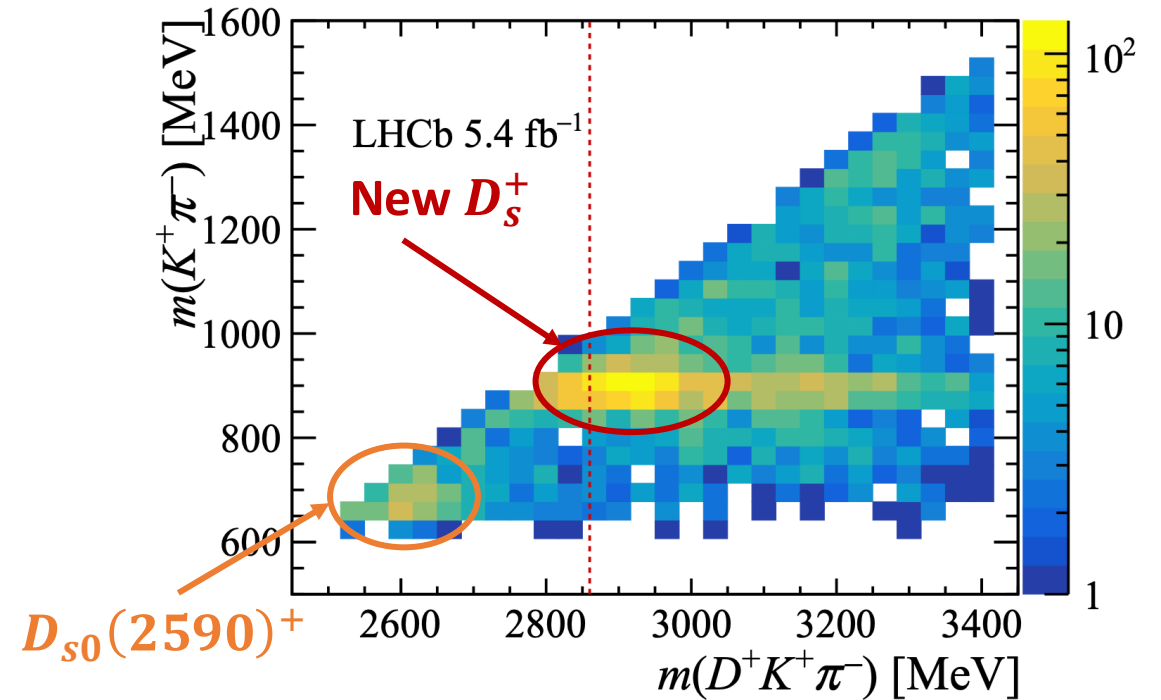
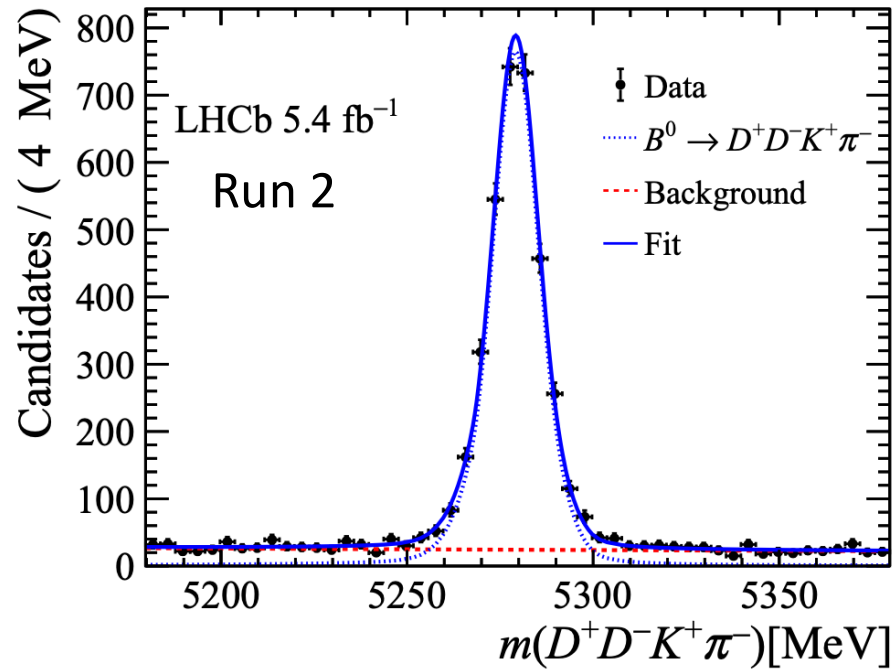
	$D_{s2}^*(2573)^+$	$D_{s3}^*(2860)^+$	QMI D -wave	QMI P -wave	QMI S -wave	NR_e	NR_u	$T_{c\bar{c}1}(4430)^-$
$D_{s2}^*(2573)^+$	1.81 ± 0.24	—	—	—	—	—	—	—
$D_{s3}^*(2860)^+$	0.00	0.28 ± 0.12	—	—	—	—	—	—
QMI D -wave	0.00	0.00	1.35 ± 0.23	—	—	—	—	—
QMI P -wave	0.00	0.00	0.00	8.34 ± 0.57	—	—	—	—
QMI S -wave	-0.04 ± 0.00	0.00	0.00	0.00	66.63 ± 1.39	—	—	—
NR_e	0.00	0.00	0.01 ± 0.01	-0.01 ± 0.01	-0.05 ± 0.02	16.04 ± 3.85	—	—
NR_u	0.00	0.00	0.00	0.00	-0.05 ± 0.02	10.34 ± 2.03	2.97 ± 1.84	—
$T_{c\bar{c}1}(4430)^-$	-0.15 ± 0.03	0.04 ± 0.01	-0.07 ± 0.09	0.01 ± 0.00	-6.56 ± 1.28	-2.04 ± 0.45	-0.17 ± 0.27	1.33 ± 0.40

Sum of fit-fractions: 98.75 (units: %)

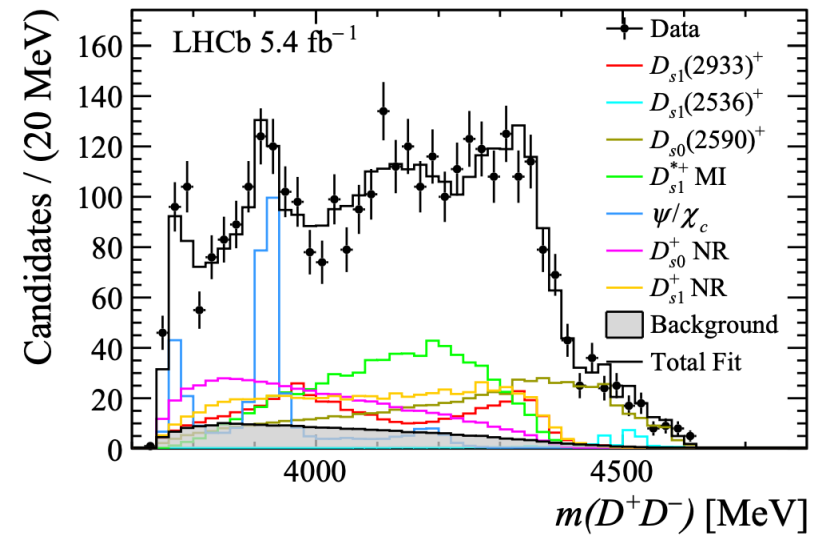
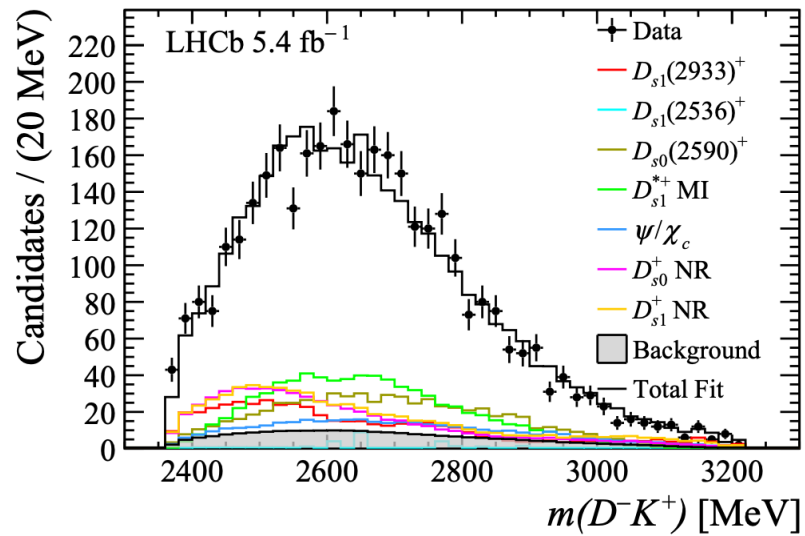
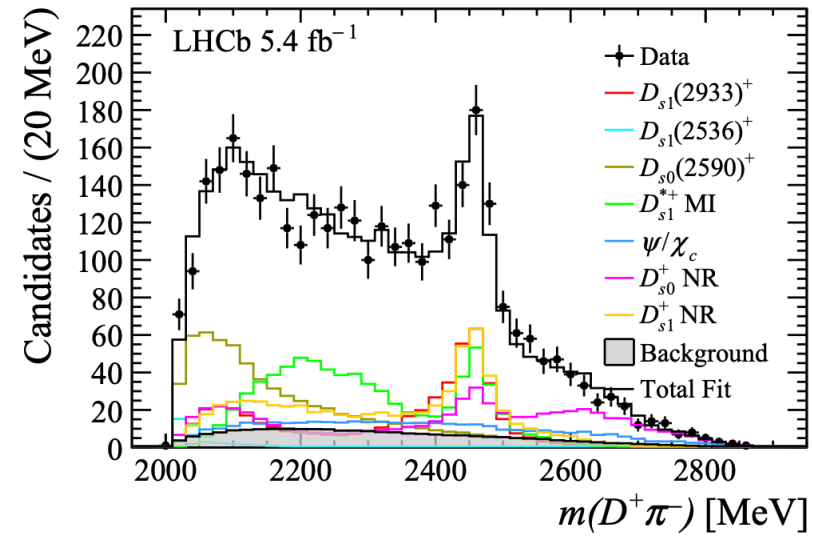
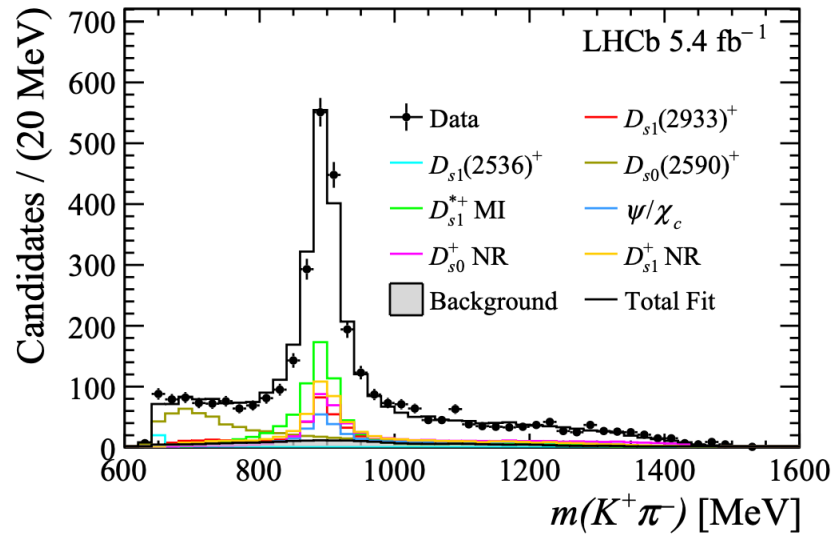
$$B^0 \rightarrow D^+ D^- K^+ \pi^-$$

- $D^+ \rightarrow K^- \pi^+ \pi^+$

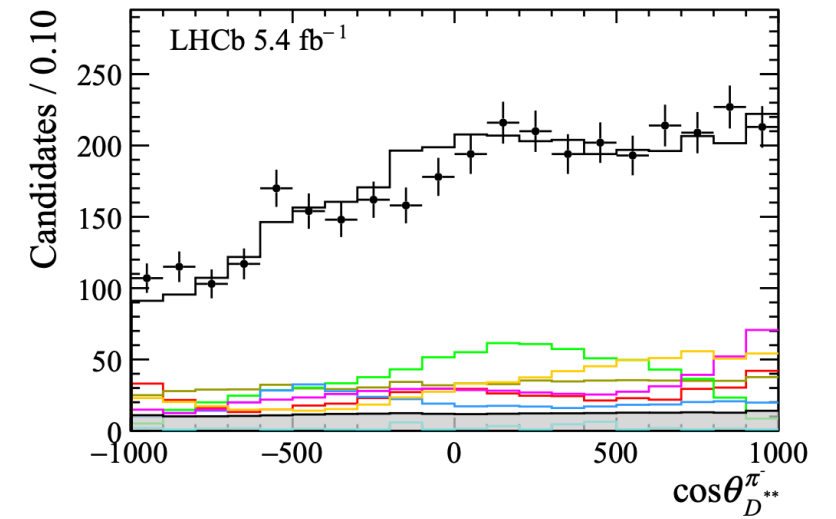
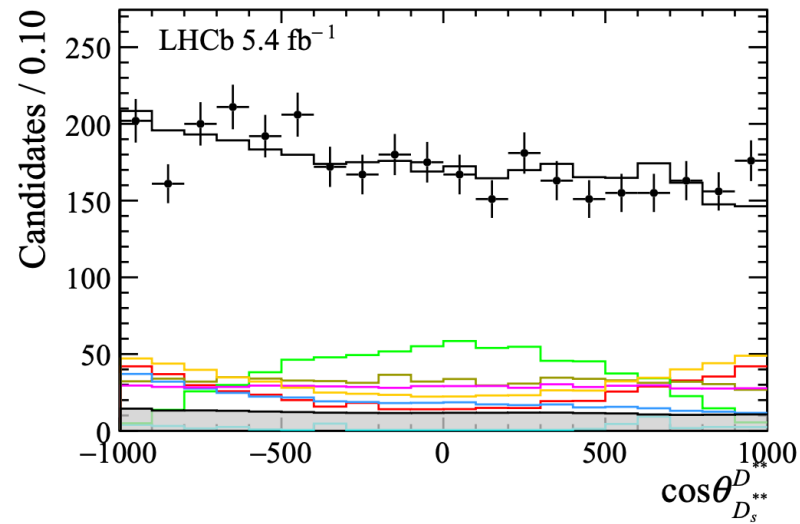
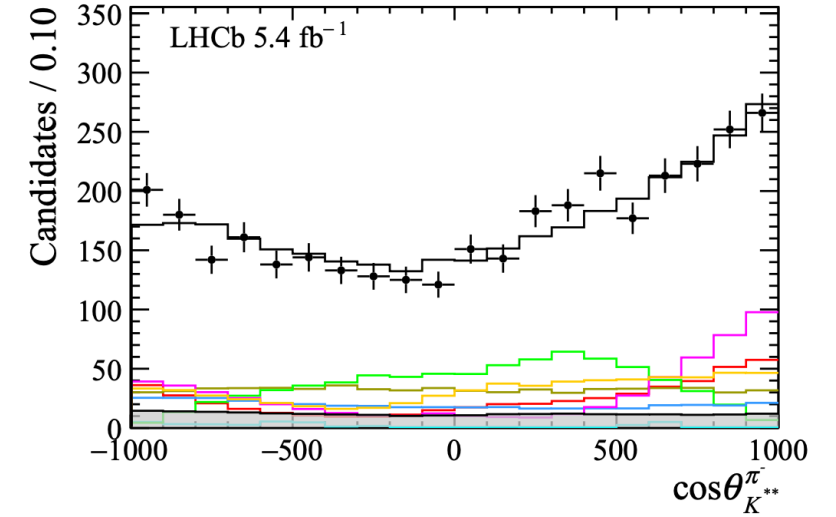
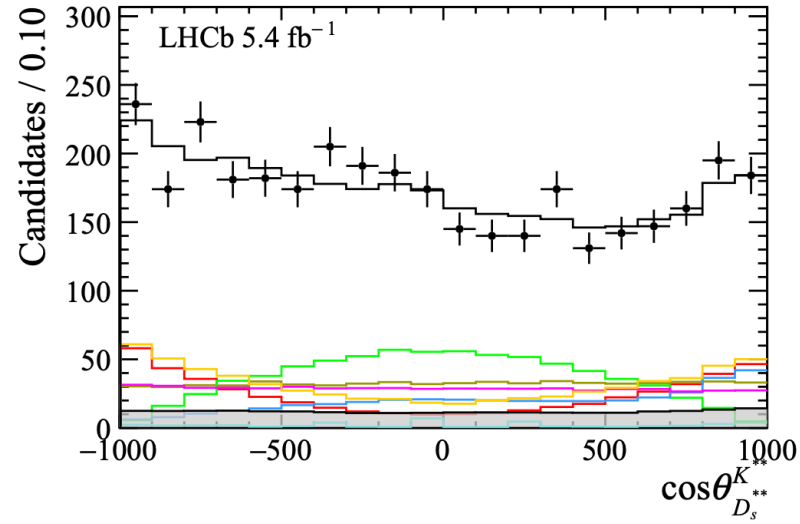
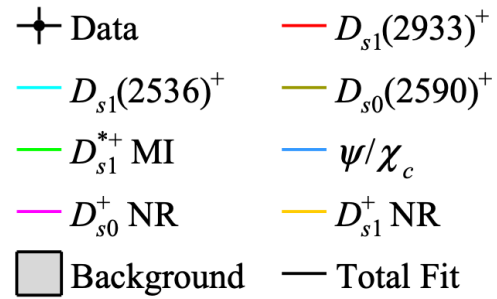
$$N_{\text{sig}} \approx 3265$$



$B^0 \rightarrow D^+ D^- K^+ \pi^-$ mass plots



$B^0 \rightarrow D^+ D^- K^+ \pi^-$ angular plots



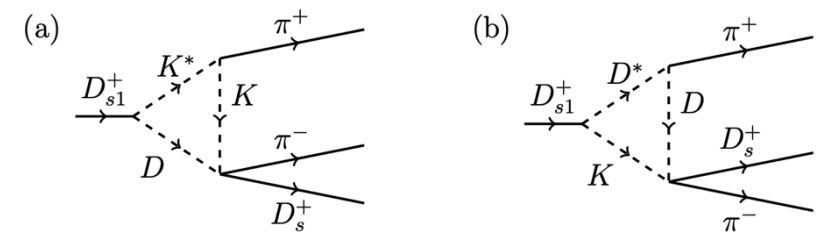
$B^0 \rightarrow D^+ D^- K^+ \pi^-$ amplitude components

Component	Fit fraction (%)
$B^0 \rightarrow D^- D_{s1}(2536)^+, D_{s1}(2536)^+ \rightarrow K^+ (D^+ \pi^-)_S$	$1.0^{+0.1+0.6}_{-0.3-0.4}$
$B^0 \rightarrow D^- D_{s0}(2590)^+, D_{s0}(2590)^+ \rightarrow D^+ (K^+ \pi^-)_S$	$21.5^{+0.4+2.5}_{-2.1-0.6}$
$B^0 \rightarrow D^- D_{s1}(2933)^+, D_{s1}(2933)^+ \rightarrow K^+ (D^+ \pi^-)_S$	$2.4^{+0.5+0.4}_{-0.7-1.3}$
$B^0 \rightarrow D^- D_{s1}(2933)^+, D_{s1}(2933)^+ \rightarrow D^+ K_1^*(892)^0$	$8.9^{+1.8+2.4}_{-2.1-1.8}$
$B^0 \rightarrow D^- D_{s1}(2933)^+, D_{s1}(2933)^+ \rightarrow K^+ D_2^*(2460)^0$	$7.0^{+6.0+3.0}_{-3.0-3.7}$
$B^0 \rightarrow D^- D_{s1}^{*+} \text{MI}, D_{s1}^{*+} \text{MI} \rightarrow D^+ K_1^*(892)^0$	$18.0^{+0.9+0.4}_{-2.4-2.0}$
$B^0 \rightarrow D^- D_{s1}^{*+} \text{MI}, D_{s1}^{*+} \text{MI} \rightarrow K^+ D_2^*(2460)^0$	$4.7^{+0.8+0.4}_{-0.5-0.3}$
$B^0 \rightarrow D^- D_{s0}^+ \text{NR}, D_{s0}^+ \text{NR} \rightarrow D^+ K_1^*(892)^0$	$8.4^{+2.2+1.9}_{-0.8-0.9}$
$B^0 \rightarrow D^- D_{s0}^+ \text{NR}, D_{s0}^+ \text{NR} \rightarrow D^+ K_1^*(1410)^0$	$1.6^{+1.1+0.7}_{-0.3-0.9}$
$B^0 \rightarrow D^- D_{s0}^+ \text{NR}, D_{s0}^+ \text{NR} \rightarrow D^+ K_2^*(1430)^0$	$1.0^{+0.5+0.9}_{-0.3-0.1}$
$B^0 \rightarrow D^- D_{s0}^+ \text{NR}, D_{s0}^+ \text{NR} \rightarrow K^+ D_2^*(2460)^0$	$1.9^{+0.5+0.3}_{-0.6-0.9}$
$B^0 \rightarrow D^- D_{s0}^+ \text{NR}, D_{s0}^+ \text{NR} \rightarrow K^+ D_1^*(2600)^0$	$1.5^{+0.8+0.4}_{-0.3-0.4}$
$B^0 \rightarrow D^- D_{s1}^+ \text{NR}, D_{s1}^+ \text{NR} \rightarrow D^+ K_1^*(892)^0$	$10.0^{+2.2+1.8}_{-1.1-1.2}$
$B^0 \rightarrow D^- D_{s1}^+ \text{NR}, D_{s1}^+ \text{NR} \rightarrow K^+ D_2^*(2460)^0$	$6.0^{+6.5+2.6}_{-3.0-4.4}$
$B^0 \rightarrow D^- D_{s1}^+ \text{NR}, D_{s1}^+ \text{NR} \rightarrow K^+ D_1^*(2600)^0$	$2.5^{+0.6+0.6}_{-0.5-0.4}$
$B^0 \rightarrow (K^+ \pi^-)_S \chi_{c0}(3915), \chi_{c0}(3915) \rightarrow D^+ D^-$	$6.7^{+0.1+0.4}_{-2.2-1.1}$
$B^0 \rightarrow K_1^*(892)^0 \chi_{c0}(3915), \chi_{c0}(3915) \rightarrow D^+ D^-$	$0.9^{+0.5+0.3}_{-0.3-0.1}$
$B^0 \rightarrow K_1^*(892)^0 \chi_{c2}(3930), \chi_{c2}(3930) \rightarrow D^+ D^-$	$0.7^{+0.4+0.2}_{-0.3-0.2}$
$B^0 \rightarrow K_1^*(892)^0 \psi(3770), \psi(3770) \rightarrow D^+ D^-$	$2.3^{+0.5+0.4}_{-0.4-0.5}$
$B^0 \rightarrow K_2^*(1430)^0 \psi(3770), \psi(3770) \rightarrow D^+ D^-$	$0.9^{+0.4+0.0}_{-0.3-0.3}$
$B^0 \rightarrow K_1^*(892)^0 \psi(4040), \psi(4040) \rightarrow D^+ D^-$	$0.9^{+0.6+0.7}_{-0.3-0.3}$
$B^0 \rightarrow K_1^*(892)^0 \psi(4160), \psi(4160) \rightarrow D^+ D^-$	$0.9^{+0.7+1.8}_{-0.1-0.3}$
Total	$109.7^{+12.4+7.5}_{-5.4-9.5}$

$D_{s1}(2460)^+ / D_{s1}(2536)^+ \rightarrow D_s^+ \pi^+ \pi^-$ models

Model	$-\Delta \log \mathcal{L}$	N_{par}	χ^2_{2460}	χ^2_{2536}
1. $f_0(500)$, $f_2(1270)$	73.7	6	146.5	114.5
2. $f_0(500)$, $f_0(980)$, $f_2(1270)$	-2.5	10	61.9	73.8
3. QMI $\pi\pi$, $f_2(1270)$	44.8	12	106.2	109.1
4. $f_0(500)$, RBW $T_{c\bar{s}0}^*$	-3.1	8	64.6	67.8
5. $f_0(500)$, RBW $T_{c\bar{s}1}^*$	-7.3	12	61.5	62.7
6. $f_0(500)$, SLA $T_{c\bar{s}0}^*$	0	8	67.0	71.1
7. $f_0(500)$, SLA $T_{c\bar{s}0}^*$, no isosymmetry	-2.7	12	63.1	69.8
8. $f_0(500)$, SLA $T_{c\bar{s}0}^*$, $\gamma_2 \neq 0$	-2.7	9	64.0	68.5
9. $f_0(500)$, Tri(D^*K)	4.0	6	77.4	69.2
10. $f_0(500)$, Tri(DK^*)	12.7	6	89.7	71.2
11. $f_0(500)$, Tri(D^*K) in $D_{s1}(2460)^+$, Tri(DK^*) in $D_{s1}(2536)^+$	4.9	6	75.0	69.7
12. $f_0(500)$, SLA $T_{c\bar{s}0}^*$ only in $D_{s1}(2460)^+$	13.1	6	69.0	82.6
13. QMI $\pi\pi$, SLA $T_{c\bar{s}0}^*$	-8.3	14	56.4	63.7
14. QMI $\pi\pi$, SLA $T_{c\bar{s}0}^*$ only in $D_{s1}(2460)^+$	1.4	12	68.5	67.7
15. $f_0(500)$, $f_2(1270)$, SLA $T_{c\bar{s}0}^*$	-5.9	12	62.4	67.2
16. $f_0(500)$, $f_2(1270)$, SLA $T_{c\bar{s}0}^*$ only in $D_{s1}(2460)^+$	5.8	10	67.7	75.7
17. $f_0(500)$, $f_2(1270)$ in $D_{s1}(2536)^+$, SLA $T_{c\bar{s}0}^*$ in $D_{s1}(2460)^+$	6.0	8	69.8	74.6

SLA: $DK \rightarrow D_s^+ \pi$ scattering



Triangle diagram (Tri) not favoured

Measured properties in $D_{s1}^+ \rightarrow D_s^+ \pi^+ \pi^-$

$T_{c\bar{s}0}^*$:

$$m = 2333 \pm 9 \text{ (stat)} \pm 11 \text{ (syst)} \text{ MeV}$$

$$\Gamma = 68 \pm 12 \text{ (stat)} \pm 14 \text{ (syst)} \text{ MeV}$$

$$J^P = 0^+$$

Compatible with those determined in
the $B \rightarrow \bar{D}^{(*)} D_s^+ \pi^+ \pi^-$ study

[Sci. Bull. 70 \(2025\) 1432–1444](#)

$D_{s1}(2460)^+$:

$$m = (2459.51 \pm 0.14 \pm 0.13 \pm 0.15) \text{ MeV}$$

$$\Gamma < 1.38 \text{ MeV} \quad (95\% \text{ CL})$$

} Most precise/stringent

$D_{s1}(2536)^+$:

$$m = (2535.18 \pm 0.04 \pm 0.05 \pm 0.16) \text{ MeV}$$

$$\frac{\mathcal{B}(D_{s1}(2536)^+ \rightarrow D_s^+ \pi^+ \pi^-)}{\mathcal{B}(D_{s1}(2536)^+ \rightarrow D^+ K^+ \pi^-)} = 1.57 \pm 0.08 \pm 0.09 \pm 0.17$$

First measurement

Uncertainties are statistical, systematic
and external, respectively

New state in the $B_s^0 \pi^0$ final state

