$P_{c\overline{c}}(4457)^+$

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

OMITTED FROM SUMMARY TABLE
was $P_c(4450)$

A resonance seen in $\Lambda_b^0 \to P_c^+ K^-$, then $P_c \to J/\psi p$, with a significance of 12 standard deviations. The $J/\psi p$ quark content is $uudc\overline{c}$, a pentaquark. See also the $P_{c\overline{c}}(4380)^+$. In the best amplitude fit, the two states have opposite parity, one having $J = 3/2$, the other $J = 5/2$.

Extraction of the pentaquark signals requires some understanding of the dominant $K^- p$ background. AAIJ 15P used a model-dependent approach. AAIJ 16AG reanalyzed the data making minimal assumptions about the $K^- p$ background, and thus confirmed the strong significance of the pentaquark signals.

$P_{c\overline{c}}(4457)^+$ MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
$4457.3 \pm 0.6^{+4.1}_{-1.7}$	AAIJ	19W	LHCB	pp at 7, 8, 13 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4449.8 \pm 1.7 \pm 2.5$	[1] AAIJ	15P	LHCB	Repl. by AAIJ 19W

[1] Considering $P_{c\overline{c}}(4440)$ and $P_{c\overline{c}}(4457)$ as a single resonance.

$P_{c\overline{c}}(4457)^+$ WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
$6.4 \pm 2.0^{+\ 5.7}_{-\ 1.9}$	AAIJ	19W	LHCB	pp at 7, 8, 13 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$39 \ \pm 5 \ \pm 19$	[1] AAIJ	15P	LHCB	Repl. by AAIJ 19W

[1] Considering $P_{c\overline{c}}(4440)$ and $P_{c\overline{c}}(4457)$ as a single resonance.

$P_{c\overline{c}}(4457)^+$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$J/\psi p$	seen
Γ_2	$\Lambda_c^+ \overline{D}^0$	not seen
Γ_3	$\Lambda_c^+ \pi^+ D^-$	not seen
Γ_4	$\Sigma_c(2455)^{++} D^-$	not seen
Γ_5	$\Sigma_c(2520)^{++} D^-$	not seen

Γ_6	$\overline{\Lambda}_c^- \pi^+ D^+$	[a] not seen
Γ_7	$\overline{\Sigma}_c(2455)^0 D^+$	[a] not seen
Γ_8	$\overline{\Sigma}_c(2520)^0 D^+$	[a] not seen
Γ_9	$\Lambda_c^+ \pi^+ D^{*-}$	not seen
Γ_{10}	$\overline{\Lambda}_c^- \pi^+ D^{*+}$	[a] not seen

[a] Searched for the charge conjugate mode from $\overline{P}^-_{c\overline{c}}$ decays.

$P_{c\overline{c}}(4457)^+$ BRANCHING RATIOS

$\Gamma(J/\psi p)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[1] POPOV	21	D0	$p\overline{p}$ at 1.96 TeV
seen	AAIJ	19W	LHCB	pp at 7, 8, 13 TeV
seen	AAIJ	15P	LHCB	pp at 7, 8 TeV

[1] Search for J/ψ inclusive production in association with a charged particle, assumed to be a proton. POPOV 21 observes a resonant signal consistent with a superposition of the $P_{c\overline{c}}(4440)^+$ and $P_{c\overline{c}}(4457)^+$, using masses and widths measured by AAIJ 19W, at significance of 3σ.

$\Gamma(\Lambda_c^+ \overline{D}^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AAIJ	24Z	LHCB	pp, 5.7 fb^{-1} at 13 TeV

$\Gamma(\Lambda_c^+ \pi^+ D^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AAIJ	24Z	LHCB	pp, 5.7 fb^{-1} at 13 TeV

$\Gamma(\Sigma_c(2455)^{++} D^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AAIJ	24Z	LHCB	pp, 5.7 fb^{-1} at 13 TeV

$\Gamma(\Sigma_c(2520)^{++} D^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AAIJ	24Z	LHCB	pp, 5.7 fb^{-1} at 13 TeV

$\Gamma(\overline{\Lambda}_c^- \pi^+ D^+)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AAIJ	24Z	LHCB	$\overline{P}^-_{c\overline{c}} \to \Lambda_c^+ \pi^- D^-$

$\Gamma(\overline{\Sigma}_c(2455)^0 D^+)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AAIJ	24Z	LHCB	$\overline{P}^-_{c\overline{c}} \to \Sigma_c(2455)^0 D^-$

$\Gamma(\overline{\Sigma}_c(2520)^0 D^+)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AAIJ	24Z	LHCB	$\overline{P}^-_{c\overline{c}} \to \Sigma_c(2520)^0 D^-$

$\Gamma(\Lambda_c^+ \pi^+ D^{*-})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AAIJ	24Z	LHCB	pp, 5.7 fb^{-1} at 13 TeV

$\Gamma(\overline{\Lambda}_c^- \pi^+ D^{*+})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
not seen	AAIJ	24Z	LHCB	$\overline{P}^-_{c\overline{c}} \to \Lambda_c^+ \pi^- D^{*-}$

$P_{c\overline{c}}(4457)^+$ REFERENCES

AAIJ	24Z	PR D110 032001	R. Aaij *et al.*	(LHCb Collab.)
POPOV	21	PAN 83 1383	A.V. Popov *et al.*	(D0 Collab.)
AAIJ	19W	PRL 122 222001	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	16AG	PRL 117 082002	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	15P	PRL 115 072001	R. Aaij *et al.*	(LHCb Collab.)