

$P_{c\bar{c}}(4457)^+$ $I(J^P) = \frac{1}{2}(??)$ Status: *OMITTED FROM SUMMARY TABLE
was $P_c(4450)$

A resonance seen in $\Lambda_b^0 \rightarrow P_c^+ K^-$, then $P_c \rightarrow J/\psi p$, with a significance of 12 standard deviations. The $J/\psi p$ quark content is $uudc\bar{c}$, a pentaquark. See also the $P_{c\bar{c}}(4380)^+$. 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.

 $P_{c\bar{c}}(4457)^+$ 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 $P_{c\bar{c}}(4440)$ and $P_{c\bar{c}}(4457)$ as a single resonance. | | | |

 $P_{c\bar{c}}(4457)^+$ 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 $P_{c\bar{c}}(4440)$ and $P_{c\bar{c}}(4457)$ as a single resonance. | | | |

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

| Mode | Fraction (Γ_i/Γ) |
|-----------------------|--------------------------------|
| Γ_1 $J/\psi p$ | seen |

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

| $\Gamma(J/\psi p)/\Gamma_{\text{total}}$ | | | | Γ_1/Γ |
|--|--------------------|------|---------|------------------------|
| VALUE | DOCUMENT ID | TECN | COMMENT | |
| seen | ¹ POPOV | 21 | D0 | $p\bar{p}$ 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 $P_{c\bar{c}}(4440)^+$ and $P_{c\bar{c}}(4457)^+$, using masses and widths measured by AAIJ 19W, at significance of 3σ .

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

| | | | | |
|-------|------|----------------|--------------------------|----------------|
| POPOV | 21 | PAN 83 1383 | A.V. Popov <i>et al.</i> | (D0 Collab.) |
| AAIJ | 19W | PRL 122 222001 | R. Aaij <i>et al.</i> | (LHCb Collab.) |
| AAIJ | 16AG | PRL 117 082002 | R. Aaij <i>et al.</i> | (LHCb Collab.) |
| AAIJ | 15P | PRL 115 072001 | R. Aaij <i>et al.</i> | (LHCb Collab.) |