



$$I(J^P) = 0(0^-)$$

$I, J, P$  need confirmation.

Quantum numbers shown are quark-model predictions.

### $B_c^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>6274.47 ± 0.27 ± 0.17</b>	<sup>1</sup> AAIJ	20R	LHCB $pp$ at 7, 8, 13 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
6274.28 ± 1.40 ± 0.32	<sup>2</sup> AAIJ	17L	LHCB Repl. by AAIJ 20R
6274.0 ± 1.8 ± 0.4	<sup>3</sup> AAIJ	14AQ	LHCB Repl. by AAIJ 20R
6276.28 ± 1.44 ± 0.36	<sup>4</sup> AAIJ	13AS	LHCB Repl. by AAIJ 20R
6273.7 ± 1.3 ± 1.6	<sup>5</sup> AAIJ	12AV	LHCB Repl. by AAIJ 20R
6275.6 ± 2.9 ± 2.5	<sup>6</sup> AALTONEN	08M	CDF $\rho\bar{p}$ at 1.96 TeV
6300 ± 14 ± 5	<sup>6</sup> ABAZOV	08T	D0 $\rho\bar{p}$ at 1.96 TeV
6285.7 ± 5.3 ± 1.2	<sup>6</sup> ABULENCIA	06C	CDF Repl. by AALTONEN 08M
6400 ± 390 ± 130	<sup>7</sup> ABE	98M	CDF $\rho\bar{p}$ at 1.8 TeV
6320 ± 60	<sup>8</sup> ACKERSTAFF	98O	OPAL $e^+e^- \rightarrow Z$

<sup>1</sup> AAIJ 20R uses the  $B_c^+ \rightarrow J/\psi\pi^+, J/\psi\pi^+\pi^-\pi^+, J/\psi p\bar{p}\pi^+, J/\psi D_s^+, J/\psi D^0 K^+$  and  $B_s^0\pi^+$  modes.

<sup>2</sup> Measured using  $B_c^+ \rightarrow J/\psi D^0 K^+$  decays.

<sup>3</sup> Uses  $B_c^+ \rightarrow J/\psi p\bar{p}\pi^+$  decays.

<sup>4</sup> AAIJ 13AS uses the  $B_c^+ \rightarrow J/\psi D_s^+$ .

<sup>5</sup> AAIJ 12AV uses the  $B_c^+ \rightarrow J/\psi\pi^+$  mode and also measures the mass difference  $M(B_c^+) - M(B^+) = 994.6 \pm 1.3 \pm 0.6 \text{ MeV}/c^2$ .

<sup>6</sup> Measured using a fully reconstructed decay mode of  $B_c \rightarrow J/\psi\pi$ .

<sup>7</sup> ABE 98M observed  $20.4_{-5.5}^{+6.2}$  events in the  $B_c^+ \rightarrow J/\psi(1S)\ell\nu_\ell$  with a significance of  $> 4.8$  standard deviations. The mass value is estimated from  $m(J/\psi(1S)\ell)$ .

<sup>8</sup> ACKERSTAFF 98O observed 2 candidate events in the  $B_c^+ \rightarrow J/\psi(1S)\pi^+$  channel with an estimated background of  $0.63 \pm 0.20$  events.

### $m_{B_c^+} - m_{B_s^0}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>907.75 ± 0.37 ± 0.27</b>	<sup>1</sup> AAIJ	20R	LHCB $pp$ at 7, 8, 13 TeV

<sup>1</sup> AAIJ 20R uses the  $B_c^+ \rightarrow J/\psi\pi^+, J/\psi\pi^+\pi^-\pi^+, J/\psi p\bar{p}\pi^+, J/\psi D_s^+, J/\psi D^0 K^+$  and  $B_s^0\pi^+$  modes.

**$B_c^+$  MEAN LIFE**

“OUR EVALUATION” is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFLAV) and are described at <https://hflav.web.cern.ch/>. The averaging/rescaling procedure takes into account correlations between the measurements.

VALUE ( $10^{-12}$ s)	DOCUMENT ID	TECN	COMMENT
<b>0.510 ± 0.009 OUR EVALUATION</b>			
<b>0.510 ± 0.009 OUR AVERAGE</b>			
0.541 ± 0.026 ± 0.014	<sup>1</sup> SIRUNYAN	18BY CMS	$pp$ at 8 TeV
0.5134 ± 0.0110 ± 0.0057	<sup>2,3</sup> AAIJ	15G LHCb	$pp$ at 7, 8 TeV
0.509 ± 0.008 ± 0.012	<sup>4</sup> AAIJ	14G LHCb	$pp$ at 8 TeV
0.452 ± 0.048 ± 0.027	<sup>3</sup> AALTONEN	13 CDF	$p\bar{p}$ at 1.96 TeV
0.448 $^{+0.038}_{-0.036}$ ± 0.032	<sup>5</sup> ABAZOV	09H D0	$p\bar{p}$ at 1.96 TeV
0.463 $^{+0.073}_{-0.065}$ ± 0.036	<sup>5</sup> ABULENCIA	06O CDF	$p\bar{p}$ at 1.96 TeV
0.46 $^{+0.18}_{-0.16}$ ± 0.03	<sup>5</sup> ABE	98M CDF	$p\bar{p}$ 1.8 TeV

<sup>1</sup> The lifetime is measured using the decays  $B_c^+ \rightarrow J/\psi \pi^+$  and  $B^+ \rightarrow J/\psi K^+$ .

<sup>2</sup> Also measures the width difference  $\Delta\Gamma = \Gamma_{B_c^+} - \Gamma_{B^+} = 4.46 \pm 0.14 \pm 0.07 \text{ mm}^{-1} \text{ c}$ .

<sup>3</sup> Uses fully reconstructed  $B_c^+ \rightarrow J/\psi \pi^+$  decays.

<sup>4</sup> Measured using  $B_c^+ \rightarrow J/\psi \mu^+ \nu_\mu X$  decays.

<sup>5</sup> The lifetime is measured from the  $J/\psi e$  decay vertices.

 **$B_c^+$  DECAY MODES  $\times B(\bar{b} \rightarrow B_c)$** 

$B_c^-$  modes are charge conjugates of the modes below.

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level
The following quantities are not pure branching ratios; rather the fraction $\Gamma_i/\Gamma \times B(\bar{b} \rightarrow B_c)$ .		
$\Gamma_1$ $J/\psi(1S)\ell^+\nu_\ell$ anything	$(8.2 \pm 1.3) \times 10^{-5}$	
$\Gamma_2$ $J/\psi(1S)\mu^+\nu_\mu$		
$\Gamma_3$ $J/\psi(1S)\tau^+\nu_\tau$		
$\Gamma_4$ $J/\psi(1S)\pi^+$	seen	
$\Gamma_5$ $J/\psi(1S)K^+$	seen	
$\Gamma_6$ $J/\psi(1S)\pi^+\pi^+\pi^-$	seen	
$\Gamma_7$ $J/\psi(1S)a_1(1260)$	$< 1.2 \times 10^{-3}$	90%
$\Gamma_8$ $J/\psi(1S)K^+K^-\pi^+$	seen	
$\Gamma_9$ $J/\psi(1S)\pi^+\pi^+\pi^-\pi^-\pi^-$	seen	
$\Gamma_{10}$ $\psi(2S)\pi^+$	seen	
$\Gamma_{11}$ $J/\psi(1S)D^0K^+$	seen	
$\Gamma_{12}$ $J/\psi(1S)D^*(2007)^0K^+$	seen	

$\Gamma_{13}$	$J/\psi(1S)D^*(2010)^+K^{*0}$	seen		
$\Gamma_{14}$	$J/\psi(1S)D^+K^{*0}$	seen		
$\Gamma_{15}$	$J/\psi(1S)D_s^+$	seen		
$\Gamma_{16}$	$J/\psi(1S)D_s^{*+}$	seen		
$\Gamma_{17}$	$J/\psi(1S)p\bar{p}\pi^+$	seen		
$\Gamma_{18}$	$\chi_c^0\pi^+$	$(2.4^{+0.9}_{-0.8}) \times 10^{-5}$		
$\Gamma_{19}$	$p\bar{p}\pi^+$	not seen		
$\Gamma_{20}$	$D^0K^+$	$(3.8^{+1.2}_{-1.1}) \times 10^{-7}$		
$\Gamma_{21}$	$D^0\pi^+$	$< 1.6$	$\times 10^{-7}$	95%
$\Gamma_{22}$	$D^{*0}\pi^+$	$< 4$	$\times 10^{-7}$	95%
$\Gamma_{23}$	$D^{*0}K^+$	$< 4$	$\times 10^{-7}$	95%
$\Gamma_{24}$	$D_s^+\bar{D}^0$	$< 1.4$	$\times 10^{-7}$	90%
$\Gamma_{25}$	$D_s^+D^0$	$< 6$	$\times 10^{-8}$	90%
$\Gamma_{26}$	$D^+\bar{D}^0$	$< 3.0$	$\times 10^{-6}$	90%
$\Gamma_{27}$	$D^+D^0$	$< 1.9$	$\times 10^{-6}$	90%
$\Gamma_{28}$	$D_s^{*+}\bar{D}^0$			
$\Gamma_{29}$	$D_s^+\bar{D}^*(2007)^0$			
$\Gamma_{30}$	$D_s^{*+}D^0$			
$\Gamma_{31}$	$D_s^+D^*(2007)^0$			
$\Gamma_{32}$	$D^*(2010)^+\bar{D}^0$	$< 6.2$	$\times 10^{-3}$	90%
$\Gamma_{33}$	$D^*(2010)^+\bar{D}^0, D^{*+} \rightarrow D^+\pi^0/\gamma$			
$\Gamma_{34}$	$D^+\bar{D}^*(2007)^0$			
$\Gamma_{35}$	$D^*(2010)^+D^0, D^{*+} \rightarrow D^+\pi^0/\gamma$			
$\Gamma_{36}$	$D^+D^*(2007)^0$			
$\Gamma_{37}$	$D_s^{*+}\bar{D}^*(2007)^0$	$< 1.7$	$\times 10^{-6}$	90%
$\Gamma_{38}$	$D_s^{*+}D^*(2007)^0$	$< 3.1$	$\times 10^{-6}$	90%
$\Gamma_{39}$	$D^*(2010)^+\bar{D}^*(2007)^0$	$< 1.0$	$\times 10^{-4}$	90%
$\Gamma_{40}$	$D^*(2010)^+D^*(2007)^0$	$< 2.0$	$\times 10^{-5}$	90%
$\Gamma_{41}$	$D^+K^{*0}$	$< 0.20$	$\times 10^{-6}$	90%
$\Gamma_{42}$	$D^+\bar{K}^{*0}$	$< 0.16$	$\times 10^{-6}$	90%
$\Gamma_{43}$	$D_s^+K^{*0}$	$< 0.28$	$\times 10^{-6}$	90%
$\Gamma_{44}$	$D_s^+\bar{K}^{*0}$	$< 0.4$	$\times 10^{-6}$	90%
$\Gamma_{45}$	$D_s^+\phi$	$< 0.32$	$\times 10^{-6}$	90%
$\Gamma_{46}$	$K^+K^0$	$< 4.6$	$\times 10^{-7}$	90%
$\Gamma_{47}$	$B_s^0\pi^+ / B(\bar{b} \rightarrow B_s)$	$(2.37^{+0.37}_{-0.35}) \times 10^{-3}$		

## $B_c^+$ BRANCHING RATIOS

### $\Gamma(J/\psi(1S)\ell^+\nu_\ell \text{ anything})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$ $\Gamma_1/\Gamma \times B$

<u>VALUE (units <math>10^{-5}</math>)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>8.2 \pm 1.3</math> OUR AVERAGE</b> Error includes scale factor of 1.4.				
$8.8 \pm 1.0 \pm 0.2$		<sup>1,2</sup> AALTONEN	16A CDF	$p\bar{p}$ at 1.96 TeV
$5.2^{+2.4}_{-2.1}$		<sup>3</sup> ABE	98M CDF	$p\bar{p}$ 1.8 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16	90	<sup>4</sup> ACKERSTAFF	98O OPAL	$e^+e^- \rightarrow Z$
<19	90	<sup>5</sup> ABREU	97E DLPH	$e^+e^- \rightarrow Z$
<12	90	<sup>6</sup> BARATE	97H ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> AALTONEN 16A reports  $[\Gamma(B_c^+ \rightarrow J/\psi(1S)\ell^+\nu_\ell \text{ anything})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow J/\psi(1S)K^+)] = 0.211 \pm 0.012^{+0.021}_{-0.020}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = (40.8 \pm 0.7) \times 10^{-2}$ ,  $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.020 \pm 0.019) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best values.

<sup>2</sup> AALTONEN 16A also measures the cross-section  $\sigma(B_c) \times B(B_c \rightarrow J/\psi\mu\nu_\mu) = 0.60 \pm 0.09$  nb and estimates the total cross-section  $\sigma(B_c)$  to be in the range  $25 \pm 4$  to  $52 \pm 8$  nb for  $p_T(B_c) > 6$  GeV/c and  $|y(B_c)| < 1$ .

<sup>3</sup> ABE 98M result is derived from the measurement of  $[\sigma(B_c) \times B(B_c \rightarrow J/\psi(1S)\ell\nu_\ell)] / [\sigma(B^+) \times B(B^+ \rightarrow J/\psi(1S)K^+)] = 0.132^{+0.041}_{-0.037}(\text{stat}) \pm 0.031(\text{sys})^{+0.032}_{-0.020}(\text{lifetime})$  by using PDG 98 values of  $B(b \rightarrow B^+)$  and  $B(B^+ \rightarrow J/\psi(1S)K^+)$ .

<sup>4</sup> ACKERSTAFF 98O reports  $B(Z \rightarrow B_c X)/B(Z \rightarrow qq) \times B(B_c \rightarrow J/\psi(1S)\ell\nu_\ell) < 6.95 \times 10^{-5}$  at 90%CL. We rescale to our PDG 98 values of  $B(Z \rightarrow b\bar{b})$ .

<sup>5</sup> ABREU 97E value listed is for an assumed  $\tau_{B_c} = 0.4$  ps and improves to  $1.6 \times 10^{-4}$  for  $\tau_{B_c} = 1.4$  ps.

<sup>6</sup> BARATE 97H reports  $B(Z \rightarrow B_c X)/B(Z \rightarrow qq) \cdot B(B_c \rightarrow J/\psi(1S)\ell\nu_\ell) < 5.2 \times 10^{-5}$  at 90%CL. We rescale to our PDG 96 values of  $B(Z \rightarrow b\bar{b})$ . A  $B_c^+ \rightarrow J/\psi(1S)\mu^+\nu_\mu$  candidate event is found, compared to all the known background sources  $2 \times 10^{-3}$ , which gives  $m_{B_c} = 5.96^{+0.25}_{-0.19}$  GeV and  $\tau_{B_c} = 1.77 \pm 0.17$  ps.

### $\Gamma(J/\psi(1S)\tau^+\nu_\tau)/\Gamma(J/\psi(1S)\mu^+\nu_\mu)$ $\Gamma_3/\Gamma_2$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.71 \pm 0.17 \pm 0.18</math></b>	<sup>1</sup> AAIJ	18C LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 18C uses  $\tau^+ \rightarrow \mu^+\nu_\mu\bar{\nu}_\tau$  mode to obtain the ratio value.

### $\Gamma(J/\psi(1S)\pi^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$ $\Gamma_4/\Gamma \times B$

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
seen		<sup>1</sup> AAIJ	15M LHCB	$pp$ at 8 TeV
seen		<sup>2</sup> KHACHATRY...15AA	CMS	$pp$ at 7 TeV
seen		AALTONEN	13 CDF	$p\bar{p}$ at 1.96 TeV
seen		<sup>3</sup> AAIJ	12AV LHCB	$pp$ at 7 TeV
seen		AALTONEN	08M CDF	$p\bar{p}$ at 1.96 TeV
seen		ABAZOV	08T D0	$p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

< $2.4 \times 10^{-4}$	90	<sup>4</sup> ACKERSTAFF	98O OPAL	$e^+e^- \rightarrow Z$
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$<3.4 \times 10^{-4}$	90	<sup>5</sup> ABREU	97E	DLPH	$e^+e^- \rightarrow Z$
$<8.2 \times 10^{-5}$	90	<sup>6</sup> BARATE	97H	ALEP	$e^+e^- \rightarrow Z$
$<2.0 \times 10^{-5}$	95	<sup>7</sup> ABE	96R	CDF	$p\bar{p}$ 1.8 TeV

<sup>1</sup> AAIJ 15M reports a measurement of  $B(B_c^+ \rightarrow J/\psi\pi^+) / B(B^+ \rightarrow J/\psi K^+) \cdot f_c/f_u = (0.683 \pm 0.018 \pm 0.009)\%$  at  $p_T(B) < 20$  GeV and  $2.0 < y(B) < 4.5$ .

<sup>2</sup> KHACHATRYAN 15AA reports a measurement of  $B(B_c^+ \rightarrow J/\psi\pi^+) / B(B^+ \rightarrow J/\psi K^+) \cdot f_c/f_u = (0.48 \pm 0.05 \pm 0.03 \pm 0.05)\%$ , at  $p_T > 15$  GeV and  $|\eta(B)| < 1.6$ .

<sup>3</sup> AAIJ 12AV reports a measurement of  $B(B_c^+ \rightarrow J/\psi\pi^+)/B(B^+ \rightarrow J/\psi K^+) f_c/f_u = (0.68 \pm 0.10 \pm 0.03 \pm 0.05)\%$  at  $p_T(B) > 4$  GeV and  $2.5 < \eta(B) < 4.5$ .

<sup>4</sup> ACKERSTAFF 98O reports  $B(Z \rightarrow B_c X)/B(Z \rightarrow qq) \times B(B_c \rightarrow J/\psi(1S)\pi^+) < 1.06 \times 10^{-4}$  at 90%CL. We rescale to our PDG 98 values of  $B(Z \rightarrow b\bar{b})$ .

<sup>5</sup> ABREU 97E value listed is for an assumed  $\tau_{B_c} = 0.4$  ps and improves to  $2.7 \times 10^{-4}$  for  $\tau_{B_c} = 1.4$  ps.

<sup>6</sup> BARATE 97H reports  $B(Z \rightarrow B_c X)/B(Z \rightarrow qq) \cdot B(B_c \rightarrow J/\psi(1S)\pi) < 3.6 \times 10^{-5}$  at 90%CL. We rescale to our PDG 96 values of  $B(Z \rightarrow b\bar{b})$ .

<sup>7</sup> ABE 96R reports  $B(b \rightarrow B_c X)/B(b \rightarrow B^+ X) \cdot B(B_c^+ \rightarrow J/\psi(1S)\pi^+)/B(B^+ \rightarrow J/\psi(1S)K^+) < 0.053$  at 95%CL for  $\tau_{B_c} = 0.8$  ps. It changes from 0.15 to 0.04 for  $0.17 \text{ ps} < \tau_{B_c} < 1.6$  ps. We rescale to our PDG 96 values of  $B(b \rightarrow B^+) = 0.378 \pm 0.022$  and  $B(B^+ \rightarrow J/\psi(1S)K^+) = 0.00101 \pm 0.00014$ .

### $\Gamma(J/\psi(1S)\pi^+)/\Gamma(J/\psi(1S)\mu^+\nu_\mu)$ $\Gamma_4/\Gamma_2$

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>4.69±0.28±0.46</b>	<sup>1</sup> AAIJ	14W LHCb	$pp$ at 7 TeV

<sup>1</sup> AAIJ 14W reports also a measurement  $B(B_c^+ \rightarrow J/\psi\pi^+) / B(B_c^+ \rightarrow J/\psi\mu^+\nu_\mu) = 0.271 \pm 0.016 \pm 0.016$  in the region  $m_{J/\psi\mu^+} > 5.3$  GeV.

### $\Gamma(J/\psi(1S)K^+)/\Gamma(J/\psi(1S)\pi^+)$ $\Gamma_5/\Gamma_4$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.079±0.007±0.003</b>		AAIJ	16AF LHCb	$pp$ at 7, 8 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.069±0.019±0.005	50	AAIJ	13BY LHCb	Repl. by AAIJ 16AF
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### $\Gamma(J/\psi(1S)\pi^+\pi^+\pi^-)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$ $\Gamma_6/\Gamma \times B$

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
seen		AAIJ	12Y LHCb	$pp$ at 7 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<5.7 \times 10^{-4}$	90	<sup>1</sup> ABREU	97E	DLPH	$e^+e^- \rightarrow Z$
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<sup>1</sup> ABREU 97E value listed is independent of  $0.4 \text{ ps} < \tau_{B_c} < 1.4$  ps.

### $\Gamma(J/\psi(1S)\pi^+\pi^+\pi^-)/\Gamma(J/\psi(1S)\pi^+)$ $\Gamma_6/\Gamma_4$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2.4 ±0.4 OUR AVERAGE</b>			
$2.55 \pm 0.80 \pm 0.33^{+0.04}_{-0.01}$	KHACHATRY...15AA	CMS	$pp$ at 7 TeV
$2.41 \pm 0.30 \pm 0.33$	AAIJ	12Y LHCb	$pp$ at 7 TeV

$\Gamma(J/\psi(1S) a_1(1260))/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_7/\Gamma \times B$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.2 \times 10^{-3}$	90	<sup>1</sup> ACKERSTAFF 980	OPAL	$e^+e^- \rightarrow Z$

<sup>1</sup> ACKERSTAFF 980 reports  $B(Z \rightarrow B_c X)/B(Z \rightarrow qq) \times B(B_c \rightarrow J/\psi(1S) a_1(1260)) < 5.29 \times 10^{-4}$  at 90%CL. We rescale to our PDG 98 values of  $B(Z \rightarrow b\bar{b})$ .

 $\Gamma(J/\psi(1S) K^+ K^- \pi^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_8/\Gamma \times B$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	<sup>1</sup> AAIJ	13CA LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> A signal yield of  $78 \pm 14$  decays is reported with a significance of 6.2 standard deviations using an integrated luminosity of  $3 \text{ fb}^{-1}$  data.

 $\Gamma(J/\psi(1S) K^+ K^- \pi^+)/\Gamma(J/\psi(1S) \pi^+)$   $\Gamma_8/\Gamma_4$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.53 \pm 0.10 \pm 0.05</math></b>	<sup>1</sup> AAIJ	13CA LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> A signal yield of  $78 \pm 14$  decays is reported with a significance of 6.2 standard deviations using an integrated luminosity of  $3 \text{ fb}^{-1}$  data.

 $\Gamma(J/\psi(1S) \pi^+ \pi^+ \pi^+ \pi^- \pi^-)/\Gamma(J/\psi(1S) \pi^+)$   $\Gamma_9/\Gamma_4$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>1.74 \pm 0.44 \pm 0.24</math></b>	<sup>1</sup> AAIJ	14P LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> A signal yield of  $32 \pm 8$  decays is reported with a significance of 4.5 standard deviations.

 $\Gamma(\psi(2S) \pi^+)/\Gamma(J/\psi(1S) \pi^+)$   $\Gamma_{10}/\Gamma_4$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.268 \pm 0.032 \pm 0.007 \pm 0.006</math></b>	<sup>1</sup> AAIJ	15AY LHCB	$pp$ at 7, 8 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.250 \pm 0.068 \pm 0.014 \pm 0.006$	<sup>1</sup> AAIJ	13AMLHCB	Repl. by AAIJ 15AY
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<sup>1</sup> The last uncertainty is due to the uncertainty of the  $B(\psi(2S) \rightarrow \mu^+ \mu^-)/B(J/\psi \rightarrow \mu^+ \mu^-)$  ratio measurement.

 $\Gamma(J/\psi(1S) D^0 K^+)/\Gamma(J/\psi(1S) \pi^+)$   $\Gamma_{11}/\Gamma_4$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.432 \pm 0.136 \pm 0.028</math></b>	AAIJ	17L LHCB	$pp$ at 7, 8 TeV

 $\Gamma(J/\psi(1S) D^*(2007)^0 K^+)/\Gamma(J/\psi(1S) D^0 K^+)$   $\Gamma_{12}/\Gamma_{11}$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>5.1 \pm 1.8 \pm 0.4</math></b>	AAIJ	17L LHCB	$pp$ at 7, 8 TeV

 $\Gamma(J/\psi(1S) D^*(2010)^+ K^{*0})/\Gamma(J/\psi(1S) D^0 K^+)$   $\Gamma_{13}/\Gamma_{11}$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>2.10 \pm 1.08 \pm 0.34</math></b>	AAIJ	17L LHCB	$pp$ at 7, 8 TeV

 $\Gamma(J/\psi(1S) D^+ K^{*0})/\Gamma(J/\psi(1S) D^0 K^+)$   $\Gamma_{14}/\Gamma_{11}$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b><math>0.63 \pm 0.39 \pm 0.08</math></b>	AAIJ	17L LHCB	$pp$ at 7, 8 TeV

$\Gamma(J/\psi(1S)D_s^+)/\Gamma(J/\psi(1S)\pi^+)$   $\Gamma_{15}/\Gamma_4$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>3.1 ± 0.5 OUR AVERAGE</b>			
3.8 ± 1.1 ± 0.4	AAD	16H ATLS	$pp$ at 7, 8 TeV
2.90 ± 0.57 ± 0.24	AAIJ	13AS LHCB	$pp$ at 7, 8 TeV

$\Gamma(J/\psi(1S)D_s^{*+})/\Gamma(J/\psi(1S)\pi^+)$   $\Gamma_{16}/\Gamma_4$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>10.4 ± 3.1 ± 1.6</b>	AAD	16H ATLS	$pp$ at 7, 8 TeV

$\Gamma(J/\psi(1S)D_s^{*+})/\Gamma(J/\psi(1S)D_s^+)$   $\Gamma_{16}/\Gamma_{15}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>2.5 ± 0.5 OUR AVERAGE</b>			
2.8 $^{+1.2}_{-0.8}$ ± 0.3	AAD	16H ATLS	$pp$ at 7, 8 TeV
2.37 ± 0.56 ± 0.10	AAIJ	13AS LHCB	$pp$ at 7, 8 TeV

$\Gamma(J/\psi(1S)p\bar{p}\pi^+)/\Gamma(J/\psi(1S)\pi^+)$   $\Gamma_{17}/\Gamma_4$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.143 <math>^{+0.041}_{-0.036}</math></b>	AAIJ	14AQ LHCB	$pp$ at 7, 8 TeV

$\Gamma(\chi_c^0\pi^+)/\Gamma_{\text{total}}$   $\Gamma_{18}/\Gamma$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b>24.0 <math>^{+8.6}_{-7.6}</math> ± 0.4</b>	1,2 AAIJ	16AT LHCB	$pp$ at 7 and 8 TeV

<sup>1</sup> AAIJ 16AT reports  $[\Gamma(B_c^+ \rightarrow \chi_c^0\pi^+)/\Gamma_{\text{total}}] \times [\Gamma(\bar{b} \rightarrow B^+)/\Gamma_{\text{total}}] = (9.8^{+3.4}_{-3.0} \pm 0.8) \times 10^{-6}$  which we divide by our best value  $\Gamma(\bar{b} \rightarrow B^+)/\Gamma_{\text{total}} = 0.408 \pm 0.007$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>2</sup> The significance of the observed signal is 4.0 standard deviations.

$\Gamma(p\bar{p}\pi^+)/\Gamma_{\text{total}}$   $\Gamma_{19}/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>not seen</b>	<sup>1</sup> AAIJ	16K LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> Measures the ratio  $(f_c/f_u) \times B(B_c^+ \rightarrow p\bar{p}\pi^+) < 3.6 \times 10^{-8}$  at 95% CL, in the region  $m(p\bar{p}) < 2.85 \text{ GeV}/c^2$ , where  $f_c$  ( $f_u$ ) represents the fragmentation fraction of the  $b$ -quark into the  $B_c^+$  ( $B_u^+$ ) meson.

$\Gamma(D^0K^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{20}/\Gamma \times B$

VALUE (units $10^{-7}$ )	DOCUMENT ID	TECN	COMMENT
<b>3.8 <math>^{+1.2}_{-1.0}</math> ± 0.1</b>	<sup>1</sup> AAIJ	17AG LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 17AG reports  $[\Gamma(B_c^+ \rightarrow D^0K^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] = (9.3^{+2.8}_{-2.5} \pm 0.6) \times 10^{-7}$  which we multiply by our best value  $B(\bar{b} \rightarrow B^+) = (40.8 \pm 0.7) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D^0\pi^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{21}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.6 \times 10^{-7}$	95	1 AAIJ	17AG LHCB	<i>pp</i> at 7, 8 TeV

<sup>1</sup>AAIJ 17AG reports  $[\Gamma(B_c^+ \rightarrow D^0\pi^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] < 3.9 \times 10^{-7}$  which we multiply by our best value  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ .

$\Gamma(D^{*0}\pi^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{22}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4 \times 10^{-7}$	95	1 AAIJ	17AG LHCB	<i>pp</i> at 7, 8 TeV

<sup>1</sup>AAIJ 17AG reports  $[\Gamma(B_c^+ \rightarrow D^{*0}\pi^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] < 1.1 \times 10^{-6}$  which we multiply by our best value  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ .

$\Gamma(D^{*0}K^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{23}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4 \times 10^{-7}$	95	1 AAIJ	17AG LHCB	<i>pp</i> at 7, 8 TeV

<sup>1</sup>AAIJ 17AG reports  $[\Gamma(B_c^+ \rightarrow D^{*0}K^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] < 1.1 \times 10^{-6}$  which we multiply by our best value  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ .

$\Gamma(D_s^+\bar{D}^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{24}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.4 \times 10^{-7}$	90	1 AAIJ	18P LHCB	<i>pp</i> at 7, 8 TeV

<sup>1</sup>AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D_s^+\bar{D}^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow \bar{D}^0 D^+)] < 0.9 \times 10^{-3}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$\Gamma(D_s^+D^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{25}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6 \times 10^{-8}$	90	1 AAIJ	18P LHCB	<i>pp</i> at 7, 8 TeV

<sup>1</sup>AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D_s^+D^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow \bar{D}^0 D^+)] < 3.7 \times 10^{-4}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$\Gamma(D^+\bar{D}^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{26}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.0 \times 10^{-6}$	90	1 AAIJ	18P LHCB	<i>pp</i> at 7, 8 TeV

<sup>1</sup>AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D^+\bar{D}^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow \bar{D}^0 D^+)] < 1.9 \times 10^{-2}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$\Gamma(D^+D^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{27}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.9 \times 10^{-6}$	90	1 AAIJ	18P LHCB	<i>pp</i> at 7, 8 TeV

<sup>1</sup>AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D^+D^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow \bar{D}^0 D^+)] < 1.2 \times 10^{-2}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .



$$\frac{[\Gamma(D_s^{*+}\bar{D}^0) + \Gamma(D_s^+\bar{D}^*(2007)^0)]/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)}{\Gamma_{32} + \Gamma_{29}} / \Gamma \times B$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 4 \times 10^{-7}$	90	1 AAIJ	18P LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D_s^{*+}\bar{D}^0) + \Gamma(B_c^+ \rightarrow D_s^+\bar{D}^*(2007)^0)]/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c) / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow \bar{D}^0 D^+)] < 2.8 \times 10^{-3}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$$\frac{[\Gamma(D_s^{*+}D^0) + \Gamma(D_s^+D^*(2007)^0)]/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)}{\Gamma_{30} + \Gamma_{31}} / \Gamma \times B$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5 \times 10^{-7}$	90	1 AAIJ	18P LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D_s^{*+}D^0) + \Gamma(B_c^+ \rightarrow D_s^+D^*(2007)^0)]/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c) / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow \bar{D}^0 D^+)] < 3.0 \times 10^{-3}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$$\frac{\Gamma(D^*(2010)^+\bar{D}^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)}{\Gamma_{32}} / \Gamma \times B$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 6.2 \times 10^{-3}$	90	1 BARATE	98Q ALEP	$e^+e^- \rightarrow Z$

<sup>1</sup> BARATE 98Q reports  $B(Z \rightarrow B_c X) \times B(B_c \rightarrow D^*(2010)^+\bar{D}^0) < 1.9 \times 10^{-3}$  at 90%CL. We rescale to our PDG 98 values of  $B(Z \rightarrow b\bar{b})$ .

$$\frac{[\Gamma(D^*(2010)^+\bar{D}^0, D^{*+} \rightarrow D^+\pi^0/\gamma) + \Gamma(D^+\bar{D}^*(2007)^0)]/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)}{\Gamma_{33} + \Gamma_{34}} / \Gamma \times B$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 9 \times 10^{-6}$	90	1 AAIJ	18P LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D^*(2010)^+\bar{D}^0, D^{*+} \rightarrow D^+\pi^0/\gamma) + \Gamma(B_c^+ \rightarrow D^+\bar{D}^*(2007)^0)]/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c) / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow \bar{D}^0 D^+)] < 5.5 \times 10^{-2}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$$\frac{[\Gamma(D^*(2010)^+D^0, D^{*+} \rightarrow D^+\pi^0/\gamma) + \Gamma(D^+D^*(2007)^0)]/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)}{\Gamma_{35} + \Gamma_{36}} / \Gamma \times B$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.4 \times 10^{-6}$	90	1 AAIJ	18P LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D^*(2010)^+D^0, D^{*+} \rightarrow D^+\pi^0/\gamma) + \Gamma(B_c^+ \rightarrow D^+D^*(2007)^0)]/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c) / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow \bar{D}^0 D^+)] < 2.2 \times 10^{-2}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$$\frac{\Gamma(D_s^{*+}\bar{D}^*(2007)^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)}{\Gamma_{37}} / \Gamma \times B$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.7 \times 10^{-6}$	90	1 AAIJ	18P LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D_s^{*+}\bar{D}^*(2007)^0)]/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c) / [B(\bar{b} \rightarrow B^+)] / [B(B^+ \rightarrow \bar{D}^0 D^+)] < 1.1 \times 10^{-2}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$\Gamma(D_s^{*+} D^*(2007)^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{38}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.1 \times 10^{-6}$	90	1 AAIJ	18P LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D_s^{*+} D^*(2007)^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+) / [B(B^+ \rightarrow \bar{D}^0 D^+)]] < 2.0 \times 10^{-2}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$\Gamma(D^*(2010)^+ \bar{D}^*(2007)^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{39}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.0 \times 10^{-4}$	90	1 AAIJ	18P LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D^*(2010)^+ \bar{D}^*(2007)^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+) / [B(B^+ \rightarrow \bar{D}^0 D^+)]] < 6.5 \times 10^{-1}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$\Gamma(D^*(2010)^+ D^*(2007)^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{40}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.0 \times 10^{-5}$	90	1 AAIJ	18P LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAIJ 18P reports  $[\Gamma(B_c^+ \rightarrow D^*(2010)^+ D^*(2007)^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+) / [B(B^+ \rightarrow \bar{D}^0 D^+)]] < 1.3 \times 10^{-1}$  which we multiply by our best values  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ ,  $B(B^+ \rightarrow \bar{D}^0 D^+) = 3.8 \times 10^{-4}$ .

$\Gamma(D^+ K^{*0})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{41}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.0 \times 10^{-7}$	90	1 AAIJ	13R LHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 13R reports  $[\Gamma(B_c^+ \rightarrow D^+ K^{*0})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+) < 0.5 \times 10^{-6}$  which we multiply by our best value  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ .

$\Gamma(D^+ \bar{K}^{*0})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{42}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.6 \times 10^{-7}$	90	1 AAIJ	13R LHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 13R reports  $[\Gamma(B_c^+ \rightarrow D^+ \bar{K}^{*0})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+) < 0.4 \times 10^{-6}$  which we multiply by our best value  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ .

$\Gamma(D_s^+ K^{*0})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{43}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.9 \times 10^{-7}$	90	1 AAIJ	13R LHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 13R reports  $[\Gamma(B_c^+ \rightarrow D_s^+ K^{*0})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+) < 0.7 \times 10^{-6}$  which we multiply by our best value  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ .

$\Gamma(D_s^+ \bar{K}^{*0})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{44}/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4 \times 10^{-7}$	90	1 AAIJ	13R LHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 13R reports  $[\Gamma(B_c^+ \rightarrow D_s^+ \bar{K}^{*0})/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+) < 1.1 \times 10^{-6}$  which we multiply by our best value  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ .

$\Gamma(D_s^+ \phi) / \Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{45} / \Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.3 \times 10^{-7}$	90	<sup>1</sup> AAIJ	13R LHCB	$pp$ at 7 TeV

<sup>1</sup> AAIJ 13R reports  $[\Gamma(B_c^+ \rightarrow D_s^+ \phi) / \Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)] / [B(\bar{b} \rightarrow B^+)] < 0.8 \times 10^{-6}$  which we multiply by our best value  $B(\bar{b} \rightarrow B^+) = 40.8 \times 10^{-2}$ .

$\Gamma(K^+ K^0) / \Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{46} / \Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 4.6 \times 10^{-7}$	90	<sup>1</sup> AAIJ	13BS LHCB	$pp$ at 7 TeV

<sup>1</sup> Derived from  $\Gamma(K^+ K^0) / \Gamma \times B(\bar{b} \rightarrow B_c) / (B(B^+ \rightarrow K^0 \pi^+) B(\bar{b} \rightarrow B^+)) < 5.8\%$  at 90% CL using normalization mode  $B(B^+ \rightarrow K^0 \pi^+) = (23.97 \pm 0.53 \pm 0.71) \times 10^{-6}$  and assuming a  $B$  production ratio  $f(\bar{b} \rightarrow B_u^+) = 0.33$ .

$\Gamma(B_s^0 \pi^+ / B(\bar{b} \rightarrow B_s)) / \Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_{47} / \Gamma \times B$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
$2.37 \pm 0.31 \pm 0.11^{+0.17}_{-0.13}$	<sup>1</sup> AAIJ	13BU LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> The last uncertainty is due to the uncertainty of the  $B_c^+$  lifetime measurement.

### POLARIZATION IN $B_c^+$ DECAY

In decays involving two vector mesons, one can distinguish among the states in which meson polarizations are both longitudinal ( $L$ ) or both are transverse and parallel ( $\parallel$ ) or perpendicular ( $\perp$ ) to each other with the parameters  $\Gamma_L / \Gamma$ ,  $\Gamma_{\perp} / \Gamma$ , and the relative phases  $\phi_{\parallel}$  and  $\phi_{\perp}$ . See the definitions in the note on “Polarization in  $B$  Decays” review in the  $B^0$  Particle Listings.

$\Gamma_L / \Gamma$  in  $B_c^+ \rightarrow J/\psi D_s^{*+}$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.54 ± 0.15 OUR AVERAGE</b>			
0.62 ± 0.24	<sup>1</sup> AAD	16H ATLS	$pp$ at 7, 8 TeV
0.48 ± 0.20	<sup>2</sup> AAIJ	13AS LHCB	$pp$ at 7, 8 TeV

<sup>1</sup> AAD 16H measures  $1 - \Gamma_L / \Gamma = 0.38 \pm 0.24$ .

<sup>2</sup> AAIJ 13AS measures  $1 - \Gamma_L / \Gamma = 0.52 \pm 0.20$ .

$A_P(B_c^+)$

$$A_P(B_c^+) = [\sigma(B_c^-) - \sigma(B_c^+)] / [\sigma(B_c^-) + \sigma(B_c^+)]$$

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>-1.0 ± 1.0 OUR AVERAGE</b>			
-2.5 ± 2.1 ± 0.5	<sup>1</sup> AAIJ	19AI LHCB	$pp$ at 7 TeV
-0.5 ± 1.1 ± 0.4	<sup>1</sup> AAIJ	19AI LHCB	$pp$ at 13 TeV

<sup>1</sup> Measured using  $B_c^+$  semileptonic decays.

$B_c^+$  REFERENCES

AAIJ	20R	JHEP 2007 123	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	19AI	PR D100 112006	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	18C	PRL 120 121801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	18P	NP B930 563	R. Aaij <i>et al.</i>	(LHCb Collab.)
SIRUNYAN	18BY	EPJ C78 457	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAIJ	17AG	PRL 118 111803	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17L	PR D95 032005	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAD	16H	EPJ C76 4	G. Aad <i>et al.</i>	(ATLAS Collab.)
AAIJ	16AF	JHEP 1609 153	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	16AT	PR D94 091102	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	16K	PL B759 313	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	16A	PR D93 052001	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AAIJ	15AY	PR D92 072007	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15G	PL B742 29	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15M	PRL 114 132001	R. Aaij <i>et al.</i>	(LHCb Collab.)
KHACHATRY...	15AA	JHEP 1501 063	V. Khachatryan <i>et al.</i>	(CMS Collab.)
AAIJ	14AQ	PRL 113 152003	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14G	EPJ C74 2839	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14P	JHEP 1405 148	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14W	PR D90 032009	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AM	PR D87 071103	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13AS	PR D87 112012	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D89 019901 (errat.)	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BS	PL B726 646	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BU	PRL 111 181801	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13BY	JHEP 1309 075	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13CA	JHEP 1311 094	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13R	JHEP 1302 043	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	13	PR D87 011101	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AAIJ	12AV	PRL 109 232001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	12Y	PRL 108 251802	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	09H	PRL 102 092001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
AALTONEN	08M	PRL 100 182002	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	08T	PRL 101 012001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABULENCIA	06C	PRL 96 082002	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABULENCIA	06O	PRL 97 012002	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABE	98M	PRL 81 2432	F. Abe <i>et al.</i>	(CDF Collab.)
Also		PR D58 112004	F. Abe <i>et al.</i>	(CDF Collab.)
ACKERSTAFF	98O	PL B420 157	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
BARATE	98Q	EPJ C4 387	R. Barate <i>et al.</i>	(ALEPH Collab.)
PDG	98	EPJ C3 1	C. Caso <i>et al.</i>	(PDG Collab.)
ABREU	97E	PL B398 207	P. Abreu <i>et al.</i>	(DELPHI Collab.)
BARATE	97H	PL B402 213	R. Barate <i>et al.</i>	(ALEPH Collab.)
ABE	96R	PRL 77 5176	F. Abe <i>et al.</i>	(CDF Collab.)
PDG	96	PR D54 1	R. M. Barnett <i>et al.</i>	(PDG Collab.)