



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

$I, J, P$  need confirmation.

Quantum numbers shown are quark-model predictions.

### $B_c^\pm$ MASS

<u>VALUE (GeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>6.277 ± 0.006 OUR AVERAGE</b>	Error includes scale factor of 1.6.		
6.2756 ± 0.0029 ± 0.0025	<sup>1</sup> AALTONEN	08M CDF	$\rho\bar{p}$ at 1.96 TeV
6.300 ± 0.014 ± 0.005	<sup>1</sup> ABAZOV	08T D0	$\rho\bar{p}$ at 1.96 TeV
6.4 ± 0.39 ± 0.13	<sup>2</sup> ABE	98M CDF	$\rho\bar{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
6.2857 ± 0.0053 ± 0.0012	<sup>1</sup> ABULENCIA	06C CDF	Repl. by AALTONEN 08M
6.32 ± 0.06	<sup>3</sup> ACKERSTAFF	98O OPAL	$e^+e^- \rightarrow Z$

<sup>1</sup> Measured using a fully reconstructed decay mode of  $B_c \rightarrow J/\psi\pi$ .

<sup>2</sup> ABE 98M observed  $20.4^{+6.2}_{-5.5}$  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>3</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.

### $B_c^\pm$ 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 (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>. The averaging/rescaling procedure takes into account correlations between the measurements.

<u>VALUE (<math>10^{-12}</math> s)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.453 ± 0.041 OUR EVALUATION</b>			
<b>0.45 ± 0.04 OUR AVERAGE</b>			
0.448 $^{+0.038}_{-0.036}$ ± 0.032	<sup>4</sup> ABAZOV	09H D0	$\rho\bar{p}$ at 1.96 TeV
0.463 $^{+0.073}_{-0.065}$ ± 0.036	<sup>5</sup> ABULENCIA	06O CDF	$\rho\bar{p}$ at 1.96 TeV
0.46 $^{+0.18}_{-0.16}$ ± 0.03	<sup>5</sup> ABE	98M CDF	$\rho\bar{p}$ 1.8 TeV

<sup>4</sup> The lifetime is measured from the  $J/\psi\mu$  decay vertices.

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

### $B_c^+$ DECAY MODES × $B(\bar{b} \rightarrow B_c)$

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

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level
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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	$(5.2^{+2.4}_{-2.1}) \times 10^{-5}$	
$\Gamma_2$	$J/\psi(1S)\pi^+$	$< 8.2 \times 10^{-5}$	90%
$\Gamma_3$	$J/\psi(1S)\pi^+\pi^+\pi^-$	$< 5.7 \times 10^{-4}$	90%
$\Gamma_4$	$J/\psi(1S)a_1(1260)$	$< 1.2 \times 10^{-3}$	90%
$\Gamma_5$	$D^*(2010)^+\bar{D}^0$	$< 6.2 \times 10^{-3}$	90%

### $B_c^+$ BRANCHING RATIOS

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$(5.2^{+2.4}_{-2.1}) \times 10^{-5}$		<sup>6</sup> ABE	98M CDF	$p\bar{p}$ 1.8 TeV

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

$< 1.6 \times 10^{-4}$	90	<sup>7</sup> ACKERSTAFF	98O OPAL	$e^+e^- \rightarrow Z$
$< 1.9 \times 10^{-4}$	90	<sup>8</sup> ABREU	97E DLPH	$e^+e^- \rightarrow Z$
$< 1.2 \times 10^{-4}$	90	<sup>9</sup> BARATE	97H ALEP	$e^+e^- \rightarrow Z$

<sup>6</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>7</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>8</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>9</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.

$\Gamma(J/\psi(1S)\pi^+)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_2/\Gamma \times B$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 8.2 \times 10^{-5}$	90	<sup>10</sup> BARATE	97H ALEP	$e^+e^- \rightarrow Z$

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

$< 2.4 \times 10^{-4}$	90	<sup>11</sup> ACKERSTAFF	98O OPAL	$e^+e^- \rightarrow Z$
$< 3.4 \times 10^{-4}$	90	<sup>12</sup> ABREU	97E DLPH	$e^+e^- \rightarrow Z$
$< 2.0 \times 10^{-5}$	95	<sup>13</sup> ABE	96R CDF	$p\bar{p}$ 1.8 TeV

<sup>10</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>11</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>12</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>13</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  $B(B^+ \rightarrow J/\psi(1S)K^+) = 0.00101 \pm 0.00014$ .

**$\Gamma(J/\psi(1S)\pi^+\pi^+\pi^-)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_3/\Gamma \times B$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 5.7 \times 10^{-4}</math></b>	90	<sup>14</sup> ABREU	97E	DLPH $e^+e^- \rightarrow Z$

<sup>14</sup> ABREU 97E value listed is independent of  $0.4 \text{ ps} < \tau_{B_c} < 1.4$  ps.

**$\Gamma(J/\psi(1S)a_1(1260))/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_4/\Gamma \times B$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 1.2 \times 10^{-3}</math></b>	90	<sup>15</sup> ACKERSTAFF	98O	OPAL $e^+e^- \rightarrow Z$

<sup>15</sup> ACKERSTAFF 98O 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  $B(Z \rightarrow b\bar{b})$ .

**$\Gamma(D^*(2010)^+\bar{D}^0)/\Gamma_{\text{total}} \times B(\bar{b} \rightarrow B_c)$   $\Gamma_5/\Gamma \times B$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt; 6.2 \times 10^{-3}</math></b>	90	<sup>16</sup> BARATE	98Q	ALEP $e^+e^- \rightarrow Z$

<sup>16</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  $B(Z \rightarrow b\bar{b})$ .

**$B_c^\pm$  REFERENCES**

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>	
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>	