



$$I(J^P) = 0(\frac{1}{2}^+) \text{ Status: } ***$$

In the quark model, a  $\Lambda_b^0$  is an isospin-0  $udb$  state. The lowest  $\Lambda_b^0$  ought to have  $J^P = 1/2^+$ . None of  $I$ ,  $J$ , or  $P$  have actually been measured.

### $\Lambda_b^0$ MASS

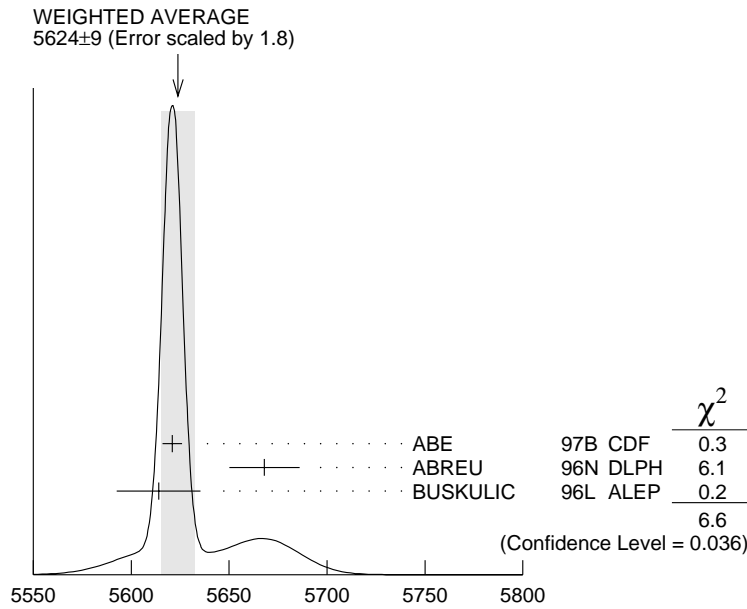
<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>5624 ± 9 OUR AVERAGE</b>	Error	includes scale factor of 1.8. See the ideogram below.		
5621 ± 4 ± 3		<sup>1</sup> ABE	97B CDF	$p\bar{p}$ at 1.8 TeV
5668 ± 16 ± 8	4	<sup>2</sup> ABREU	96N DLPH	$e^+e^- \rightarrow Z$
5614 ± 21 ± 4	4	<sup>2</sup> BUSKULIC	96L ALEP	$e^+e^- \rightarrow Z$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
not seen		<sup>3</sup> ABE	93B CDF	Sup. by ABE 97B
5640 ± 50 ± 30	16	<sup>4</sup> ALBAJAR	91E UA1	$p\bar{p}$ 630 GeV
5640 <sup>+100</sup> <sub>-210</sub>	52	BARI	91 SFM	$\Lambda_b^0 \rightarrow \rho D^0 \pi^-$
5650 <sup>+150</sup> <sub>-200</sub>	90	BARI	91 SFM	$\Lambda_b^0 \rightarrow \Lambda_c^+ \pi^+ \pi^- \pi^-$

<sup>1</sup> ABE 97B observed 38 events above a background  $18 \pm 1.6$  events in the mass range 5.60–5.65 GeV/ $c^2$ , a significance of  $> 3.4$  standard deviations.

<sup>2</sup> Uses 4 fully reconstructed  $\Lambda_b$  events.

<sup>3</sup> ABE 93B states that, based on the signal claimed by ALBAJAR 91E, CDF should have found  $30 \pm 23 \Lambda_b^0 \rightarrow J/\psi(1S)\Lambda$  events. Instead, CDF found not more than 2 events.

<sup>4</sup> ALBAJAR 91E claims  $16 \pm 5$  events above a background of  $9 \pm 1$  events, a significance of about 5 standard deviations.



$\Lambda_b^0$  mass (MeV)

## $\Lambda_b^0$ MEAN LIFE

These are actually measurements of the average lifetime of weakly decaying  $b$  baryons weighted by generally unknown production rates, branching fractions, and detection efficiencies. Presumably, the mix is mainly  $\Lambda_b^0$ , with some  $\Xi_b^0$  and  $\Xi_b^-$ .

See  $b$ -baryon Admixture section for data on  $b$ -baryon mean life average over species of  $b$ -baryon particles.

“OUR EVALUATION” is an average of the data listed below performed by the LEP  $B$  Lifetimes Working Group as described in our review “Production and Decay of  $b$ -flavored Hadrons” in the  $B^\pm$  Section of the Listings. The averaging procedure takes into account correlations between the measurements and asymmetric lifetime errors.

VALUE ( $10^{-12}$ s)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.24 ± 0.08 OUR EVALUATION</b>				
1.29 <sup>+0.24</sup> <sub>-0.22</sub> ± 0.06		<sup>5</sup> ACKERSTAFF	98G OPAL	$e^+ e^- \rightarrow Z$
1.21 ± 0.11		<sup>5</sup> BARATE	98D ALEP	$e^+ e^- \rightarrow Z$
1.32 ± 0.15 ± 0.07		ABE	96M CDF	Excess $\Lambda_c \ell^-$ , decay lengths
1.19 <sup>+0.21</sup> <sub>-0.18</sub> <sup>+0.07</sup> <sub>-0.08</sub>		ABREU	96D DLP	Excess $\Lambda_c \ell^-$ , decay lengths
• • •				We do not use the following data for averages, fits, limits, etc. • • •
1.14 <sup>+0.22</sup> <sub>-0.19</sub> ± 0.07	69	AKERS	95K OPAL	Repl. by ACKERSTAFF 98G
1.02 <sup>+0.23</sup> <sub>-0.18</sub> ± 0.06	44	BUSKULIC	95L ALEP	Repl. by BARATE 98D

<sup>5</sup> Measured using  $\Lambda_c \ell^-$  and  $\Lambda \ell^+ \ell^-$ .

## $\Lambda_b^0$ DECAY MODES

These branching fractions are actually an average over weakly decaying  $b$ -baryons weighted by their production rates in  $Z$  decay (or high-energy  $p\bar{p}$ ), branching ratios, and detection efficiencies. They scale with the LEP  $b$ -baryon production fraction  $B(b \rightarrow b\text{-baryon})$  and are evaluated for our value  $B(b \rightarrow b\text{-baryon}) = (10.1^{+3.9}_{-3.1})\%$ .

The branching fractions  $B(b\text{-baryon} \rightarrow \Lambda \ell^- \bar{\nu}_\ell \text{ anything})$  and  $B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{ anything})$  are not pure measurements because the underlying measured products of these with  $B(b \rightarrow b\text{-baryon})$  were used to determine  $B(b \rightarrow b\text{-baryon})$ , as described in the note "Production and Decay of  $b$ -Flavored Hadrons."

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level
$\Gamma_1$ $J/\psi(1S)\Lambda$	$(4.7 \pm 2.8) \times 10^{-4}$	
$\Gamma_2$ $pD^0\pi^-$		
$\Gamma_3$ $\Lambda_c^+\pi^-$	seen	
$\Gamma_4$ $\Lambda_c^+a_1(1260)^-$	seen	
$\Gamma_5$ $\Lambda_c^+\pi^+\pi^-\pi^-$		
$\Gamma_6$ $\Lambda K^0 2\pi^+ 2\pi^-$		
$\Gamma_7$ $\Lambda_c^+ \ell^- \bar{\nu}_\ell \text{ anything}$	[a] $(9.0^{+3.1}_{-3.8})\%$	
$\Gamma_8$ $p\pi^-$	$< 5.0 \times 10^{-5}$	90%
$\Gamma_9$ $pK^-$	$< 5.0 \times 10^{-5}$	90%

[a] Not a pure measurement. See note at head of  $\Lambda_b^0$  Decay Modes.

## $\Lambda_b^0$ BRANCHING RATIOS

$\Gamma(J/\psi(1S)\Lambda)/\Gamma_{\text{total}}$   $\Gamma_1/\Gamma$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>4.7 \pm 2.1 \pm 1.9</math></b>		<sup>6</sup> ABE	97B CDF	$p\bar{p}$ at 1.8 TeV

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

$178.2 \pm 108.9^{+54.7}_{-68.8}$	16	<sup>7</sup> ALBAJAR	91E UA1	$J/\psi(1S) \rightarrow \mu^+ \mu^-$
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<sup>6</sup> ABE 97B reports  $(0.037 \pm 0.017(\text{stat}) \pm 0.007(\text{sys}))\%$  for  $B(b \rightarrow b\text{-baryon}) = 0.1$  and for  $B(B^0 \rightarrow J/\psi(1S)K_S^0) = 0.037\%$ . We rescale to our PDG 97 best value  $B(b \rightarrow b\text{-baryon}) = (10.1^{+3.9}_{-3.1})\%$  and  $B(B^0 \rightarrow J/\psi(1S)K_S^0) = (0.044 \pm 0.006)\%$ . Our first error is their experiments's error and our second error is the systematic error from using our best value.

<sup>7</sup> ALBAJAR 91E reports  $180 \pm 110$  for  $B(\bar{b} \rightarrow b\text{-baryon}) = 0.10$ . We rescale to our best value  $B(\bar{b} \rightarrow b\text{-baryon}) = (10.1^{+3.9}_{-3.1}) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\rho D^0 \pi^-)/\Gamma_{\text{total}}$   $\Gamma_2/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	52	BARI	91 SFM	$D^0 \rightarrow K^- \pi^+$
seen		BASILE	81 SFM	$D^0 \rightarrow K^- \pi^+$

$\Gamma(\Lambda_c^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_3/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	3	ABREU	96N DLPH	$\Lambda_c^+ \rightarrow p K^- \pi^+$
<b>seen</b>	4	BUSKULIC	96L ALEP	$\Lambda_c^+ \rightarrow p K^- \pi^+, \rho \bar{K}^0,$ $\Lambda \pi^+ \pi^+ \pi^-$

$\Gamma(\Lambda_c^+ a_1(1260)^-)/\Gamma_{\text{total}}$   $\Gamma_4/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	1	ABREU	96N DLPH	$\Lambda_c^+ \rightarrow p K^- \pi^+,$ $a_1^- \rightarrow \rho^0 \pi^- \rightarrow$ $\pi^+ \pi^- \pi^-$

$\Gamma(\Lambda_c^+ \pi^+ \pi^- \pi^-)/\Gamma_{\text{total}}$   $\Gamma_5/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	90	BARI	91 SFM	$\Lambda_c^+ \rightarrow p K^- \pi^+$

$\Gamma(\Lambda K^0 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$   $\Gamma_6/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	4	<sup>8</sup> ARENTON	86 FMPS	$\Lambda K_S^0 2\pi^+ 2\pi^-$

<sup>8</sup>See the footnote to the ARENTON 86 mass value.

$\Gamma(\Lambda_c^+ \ell^- \bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}$   $\Gamma_7/\Gamma$

The values and averages in this section serve only to show what values result if one assumes our  $B(b \rightarrow b\text{-baryon})$ . They cannot be thought of as measurements since the underlying product branching fractions were also used to determine  $B(b \rightarrow b\text{-baryon})$  as described in the note on "Production and Decay of  $b$ -Flavored Hadrons."

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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**0.090<sup>+0.031</sup><sub>-0.038</sub> OUR AVERAGE**

0.085 ± 0.015 <sup>+0.026</sup> <sub>-0.033</sub>		<sup>9</sup> BARATE	98D ALEP	$e^+ e^- \rightarrow Z$
0.12 <sup>+0.04</sup> <sub>-0.03</sub> <sup>+0.04</sup> <sub>-0.05</sub>	29	<sup>10</sup> ABREU	95S DLPH	$e^+ e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.075 ± 0.018 <sup>+0.023</sup> <sub>-0.029</sub>	55	<sup>11</sup> BUSKULIC	95L ALEP	Repl. by BARATE 98D
0.15 ± 0.06 <sup>+0.05</sup> <sub>-0.06</sub>	21	<sup>12</sup> BUSKULIC	92E ALEP	$\Lambda_c^+ \rightarrow p K^- \pi^+$

<sup>9</sup> BARATE 98D reports  $[B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{ anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.0086 \pm 0.0007 \pm 0.0014$ . We divide by our best value  $B(\bar{b} \rightarrow b\text{-baryon}) = (10.1<sup>+3.9</sup><sub>-3.1</sub>) \times 10^{-2}$ .

Our first error is their experiment's error and our second error is the systematic error from using our best value. Measured using  $\Lambda_c^- \ell^-$  and  $\Lambda_c^+ \ell^-$ .

<sup>10</sup> ABREU 95S reports  $[B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{ anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.0118 \pm 0.0026^{+0.0031}_{-0.0021}$ . We divide by our best value  $B(\bar{b} \rightarrow b\text{-baryon}) = (10.1^{+3.9}_{-3.1}) \times 10^{-2}$ .

Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>11</sup> BUSKULIC 95L reports  $[B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{ anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.00755 \pm 0.0014 \pm 0.0012$ . We divide by our best value  $B(\bar{b} \rightarrow b\text{-baryon}) = (10.1^{+3.9}_{-3.1}) \times 10^{-2}$ .

Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>12</sup> BUSKULIC 92E reports  $[B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{ anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.015 \pm 0.0035 \pm 0.0045$ . We divide by our best value  $B(\bar{b} \rightarrow b\text{-baryon}) = (10.1^{+3.9}_{-3.1}) \times 10^{-2}$ .

Our first error is their experiment's error and our second error is the systematic error from using our best value. Superseded by BUSKULIC 95L.

### $\Gamma(p\pi^-)/\Gamma_{\text{total}}$

$\Gamma_8/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt;5.0 \times 10^{-5}</math></b>	90	<sup>13</sup> BUSKULIC	96V ALEP	$e^+ e^- \rightarrow Z$

<sup>13</sup> BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.

### $\Gamma(pK^-)/\Gamma_{\text{total}}$

$\Gamma_9/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b><math>&lt;5.0 \times 10^{-5}</math></b>	90	<sup>14</sup> BUSKULIC	96V ALEP	$e^+ e^- \rightarrow Z$
• • •				We do not use the following data for averages, fits, limits, etc. • • •
$<3.6 \times 10^{-4}$	90	<sup>15</sup> ADAM	96D DLPH	$e^+ e^- \rightarrow Z$

<sup>14</sup> BUSKULIC 96V assumes PDG 96 production fractions for  $B^0$ ,  $B^+$ ,  $B_s$ ,  $b$  baryons.  
<sup>15</sup> ADAM 96D assumes  $f_{B^0} = f_{B^-} = 0.39$  and  $f_{B_s} = 0.12$ .

## $\Lambda_b^0$ REFERENCES

ACKERSTAFF	98G	PL B426 161	K. Ackerstaff+	(OPAL Collab.)
BARATE	98D	EPJ C2 197	R. Barate+	(ALEPH Collab.)
ABE	97B	PR D55 1142	+Akimoto, Akopian, Albrow+	(CDF Collab.)
PDG	97	Unofficial 1997 WWW edition		
ABE	96M	PRL 77 1439	+Akimoto, Akopian, Albrow+	(CDF Collab.)
ABREU	96D	ZPHY C71 199	+Adam, Adye, Agasi+	(DELPHI Collab.)
ABREU	96N	PL B374 351	+Adam, Adye, Agasi+	(DELPHI Collab.)
ADAM	96D	ZPHY C72 207	W. Adam+	(DELPHI Collab.)
BUSKULIC	96L	PL B380 442	+De Bonis, Decamp, Ghez+	(ALEPH Collab.)
BUSKULIC	96V	PL B384 471	+De Bonis, Decamp, Ghez+	(ALEPH Collab.)
PDG	96	PR D54 1		
ABREU	95S	ZPHY C68 375	+Adam, Adye, Agasi+	(DELPHI Collab.)
AKERS	95K	PL B353 402	+Alexander, Allison, Altekamp+	(OPAL Collab.)
BUSKULIC	95L	PL B357 685	+Casper, De Bonis, Decamp+	(ALEPH Collab.)
ABE	93B	PR D47 R2639	+Amidei, Anway-Wiese, Apollinari+	(CDF Collab.)
BUSKULIC	92E	PL B294 145	+Decamp, Goy, Lees, Minard+	(ALEPH Collab.)
ALBAJAR	91E	PL B273 540	+Albrow, Allkofer, Ankoviak+	(UA1 Collab.)
BARI	91	NC 104A 1787	+Basile, Bruni, Cara Romeo+	(CERN R422 Collab.)
ARENTON	86	NP B274 707	+Chen, Cormell, Dieterle+	(ARIZ, NDAM, VAND)
BASILE	81	LNC 31 97	+Bonvicini, Romeo+	(CERN R415 Collab.)