

b -baryon ADMIXTURE (Λ_b , Ξ_b , Σ_b , Ω_b)

b -baryon ADMIXTURE MEAN LIFE

Each measurement of the b -baryon mean life is an average over an admixture of various b baryons which decay weakly. Different techniques emphasize different admixtures of produced particles, which could result in a different b -baryon mean life. More b -baryon flavor specific channels are not included in the measurement.

“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 these Listings. The averaging procedure takes into account correlations between the measurements and asymmetric lifetime errors.

VALUE (10^{-12} s)	EVTS	DOCUMENT ID	TECN	COMMENT
1.208 ± 0.051 OUR EVALUATION				
1.16 ± 0.20 ± 0.08		¹ ABREU	99W DLPH	$e^+ e^- \rightarrow Z$
1.19 ± 0.14 ± 0.07		² ABREU	99W DLPH	$e^+ e^- \rightarrow Z$
1.20 ± 0.08 ± 0.06		³ BARATE	98D ALEP	$e^+ e^- \rightarrow Z$
1.10 $^{+0.19}_{-0.17}$ ± 0.09		ABREU	96D DLPH	Excess $\Lambda\mu^-$ impact parameters
1.16 ± 0.11 ± 0.06		AKERS	96 OPAL	Excess $\Lambda\ell^-$, decay lengths and impact parameters
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.14 ± 0.08 ± 0.04		⁴ ABREU	99W DLPH	$e^+ e^- \rightarrow Z$
1.46 $^{+0.22}_{-0.21}$ $^{+0.07}_{-0.09}$		ABREU	96D DLPH	Repl. by ABREU 99W
1.27 $^{+0.35}_{-0.29}$ ± 0.09		ABREU	95S DLPH	Repl. by ABREU 99W
1.05 $^{+0.12}_{-0.11}$ ± 0.09	290	BUSKULIC	95L ALEP	Repl. by BARATE 98D
1.04 $^{+0.48}_{-0.38}$ ± 0.10	11	⁵ ABREU	93F DLPH	Excess $\Lambda\mu^-$, decay lengths
1.05 $^{+0.23}_{-0.20}$ ± 0.08	157	⁶ AKERS	93 OPAL	Excess $\Lambda\ell^-$, decay lengths
1.12 $^{+0.32}_{-0.29}$ ± 0.16	101	⁷ BUSKULIC	92I ALEP	Excess $\Lambda\ell^-$, impact parameters

¹ Measured using $\Lambda\ell^-$ decay length.

² Measured using $p\ell^-$ decay length.

³ Measured using the excess of $\Lambda\ell^-$, lepton impact parameter.

⁴ This ABREU 99W result is the combined result of the $\Lambda\ell^-$, $p\ell^-$, and excess $\Lambda\mu^-$ impact parameter measurements.

⁵ ABREU 93F superseded by ABREU 96D.

⁶ AKERS 93 superseded by AKERS 96.

⁷ BUSKULIC 92I superseded by BUSKULIC 95L.

b -baryon ADMIXTURE ($\Lambda_b, \Xi_b, \Sigma_b, \Omega_b$)

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 $B(b \rightarrow b\text{-baryon}) = (11.6 \pm 2.0)\%$.

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 (Γ_i/Γ)
Γ_1	$p\mu^- \bar{\nu}$ anything	$(4.2^{+1.8}_{-1.5})\%$
Γ_2	$p\ell\bar{\nu}_\ell$ anything	$(4.1 \pm 1.0)\%$
Γ_3	p anything	$(51 \pm 17)\%$
Γ_4	$\Lambda\ell^- \bar{\nu}_\ell$ anything	$(2.7 \pm 0.8)\%$
Γ_5	$\Lambda\ell^+ \nu_\ell$ anything	
Γ_6	Λ anything	
Γ_7	$\Lambda_c^+ \ell^- \bar{\nu}_\ell$ anything	
Γ_8	$\Lambda/\bar{\Lambda}$ anything	$(28 \pm 7)\%$
Γ_9	$\Xi^- \ell^- \bar{\nu}_\ell$ anything	$(4.8 \pm 1.3) \times 10^{-3}$

b -baryon ADMIXTURE ($\Lambda_b, \Xi_b, \Sigma_b, \Omega_b$) BRANCHING RATIOS

$\Gamma(p\mu^- \bar{\nu}\text{anything})/\Gamma_{\text{total}}$		Γ_1/Γ		
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.042^{+0.016}_{-0.013} \pm 0.007$	125	⁸ ABREU	95S DLPH	$e^+e^- \rightarrow Z$

⁸ ABREU 95S reports $[B(b\text{-baryon} \rightarrow p\mu^- \bar{\nu}\text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.0049 \pm 0.0011^{+0.0015}_{-0.0011}$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(p\ell\bar{\nu}_\ell\text{anything})/\Gamma_{\text{total}}$		Γ_2/Γ		
VALUE		DOCUMENT ID	TECN	COMMENT
$0.041 \pm 0.007 \pm 0.007$		⁹ BARATE	98V ALEP	$e^+e^- \rightarrow Z$

⁹ BARATE 98V reports $[B(b\text{-baryon} \rightarrow p\ell\bar{\nu}_\ell\text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = (4.72 \pm 0.66 \pm 0.44) \times 10^{-3}$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(p\ell\bar{\nu}_\ell\text{anything})/\Gamma(p\text{anything})$		Γ_2/Γ_3		
VALUE		DOCUMENT ID	TECN	COMMENT
$0.080 \pm 0.012 \pm 0.014$		BARATE	98V ALEP	$e^+e^- \rightarrow Z$

$\Gamma(\Lambda\ell^-\bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}$ Γ_4/Γ

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
0.027±0.008 OUR AVERAGE				
0.028±0.004±0.005		¹⁰ BARATE	98D ALEP	$e^+e^- \rightarrow Z$
0.025±0.003±0.004		¹¹ AKERS	96 OPAL	Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$
0.026±0.006±0.004	262	¹² ABREU	95S DLPH	Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$
0.053±0.010±0.009	290	¹³ BUSKULIC	95L ALEP	Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	157	¹⁴ AKERS	93 OPAL	Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$
0.060±0.018±0.010	101	¹⁵ BUSKULIC	92I ALEP	Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$

¹⁰ BARATE 98D reports $[B(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.00326 \pm 0.00016 \pm 0.00039$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Measured using the excess of $\Lambda\ell^-$, lepton impact parameter.

¹¹ AKERS 96 reports $[B(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.00291 \pm 0.00023 \pm 0.00025$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹² ABREU 95S reports $[B(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.0030 \pm 0.0006 \pm 0.0004$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹³ BUSKULIC 95L reports $[B(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.0061 \pm 0.0006 \pm 0.0010$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹⁴ AKERS 93 superseded by AKERS 96.

¹⁵ BUSKULIC 92I reports $[B(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.0070 \pm 0.0010 \pm 0.0018$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. 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.

 $\Gamma(\Lambda\ell^+\nu_\ell \text{ anything})/\Gamma(\Lambda \text{ anything})$ Γ_5/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
0.080±0.012±0.008			
	ABBIENDI	99L OPAL	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.070±0.012±0.007	ACKERSTAFF	97N OPAL	Repl. by ABBIENDI 99L

 $\Gamma(\Lambda/\bar{\Lambda} \text{ anything})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.28±0.07 OUR AVERAGE			
0.30±0.04±0.05	¹⁶ ABBIENDI	99L OPAL	$e^+e^- \rightarrow Z$
0.19 ^{+0.11} _{-0.07} ±0.03	¹⁷ ABREU	95C DLPH	$e^+e^- \rightarrow Z$

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

$0.34 \pm 0.05 \pm 0.06$

¹⁸ ACKERSTAFF 97N OPAL Repl. by ABBIENDI 99L

¹⁶ ABBIENDI 99L reports $[B(b\text{-baryon} \rightarrow \Lambda/\bar{\Lambda}\text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.035 \pm 0.0032 \pm 0.0035$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹⁷ ABREU 95C reports $0.28^{+0.17}_{-0.12}$ for $B(\bar{b} \rightarrow b\text{-baryon}) = 0.08 \pm 0.02$. We rescale to our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹⁸ ACKERSTAFF 97N reports $[B(b\text{-baryon} \rightarrow \Lambda/\bar{\Lambda}\text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.0393 \pm 0.0046 \pm 0.0037$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0048 ± 0.0013 OUR AVERAGE			

0.0047 ± 0.0012 ± 0.0008	¹⁹ BUSKULIC	96T ALEP	Excess $\Xi^- \ell^-$ over $\Xi^- \ell^+$
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0.0051 ± 0.0020 ± 0.0009	²⁰ ABREU	95V DLPH	Excess $\Xi^- \ell^-$ over $\Xi^- \ell^+$
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¹⁹ BUSKULIC 96T reports $[B(b\text{-baryon} \rightarrow \Xi^- \ell^- \bar{\nu}_\ell \text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.00054 \pm 0.00011 \pm 0.00008$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

²⁰ ABREU 95V reports $[B(b\text{-baryon} \rightarrow \Xi^- \ell^- \bar{\nu}_\ell \text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.00059 \pm 0.00021 \pm 0.0001$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (11.6 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

b -baryon ADMIXTURE (Λ_b , Ξ_b , Σ_b , Ω_b) REFERENCES

ABBIENDI	99L	EPJ C9 1	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
ABREU	99W	EPJ C10 185	P. Abreu <i>et al.</i>	(DELPHI Collab.)
BARATE	98D	EPJ C2 197	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARATE	98V	EPJ C5 205	R. Barate <i>et al.</i>	(ALEPH Collab.)
ACKERSTAFF	97N	ZPHY C74 423	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ABREU	96D	ZPHY C71 199	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AKERS	96	ZPHY C69 195	R. Akers <i>et al.</i>	(OPAL Collab.)
BUSKULIC	96T	PL B384 449	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ABREU	95C	PL B347 447	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ABREU	95S	ZPHY C68 375	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ABREU	95V	ZPHY C68 541	P. Abreu <i>et al.</i>	(DELPHI Collab.)
BUSKULIC	95L	PL B357 685	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ABREU	93F	PL B311 379	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AKERS	93	PL B316 435	R. Akers <i>et al.</i>	(OPAL Collab.)
BUSKULIC	92I	PL B297 449	D. Buskulic <i>et al.</i>	(ALEPH Collab.)