

b-baryon ADMIXTURE (Λ_b , Ξ_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.

| VALUE (10^{-12} s) | EVTS | DOCUMENT ID | TECN | COMMENT |
|---|------|--------------|----------|--|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | | |
| $1.218^{+0.130}_{-0.115} \pm 0.042$ | | 1 ABAZOV | 07S D0 | Repl. by ABAZOV 12U |
| $1.22^{+0.22}_{-0.18} \pm 0.04$ | | 1 ABAZOV | 05C D0 | Repl. by ABAZOV 07S |
| $1.16 \pm 0.20 \pm 0.08$ | | 2 ABREU | 99W DLPH | $e^+e^- \rightarrow Z$ |
| $1.19 \pm 0.14 \pm 0.07$ | | 3 ABREU | 99W DLPH | $e^+e^- \rightarrow Z$ |
| $1.14 \pm 0.08 \pm 0.04$ | | 4 ABREU | 99W DLPH | $e^+e^- \rightarrow Z$ |
| $1.11^{+0.19}_{-0.18} \pm 0.05$ | | 5 ABREU | 99W DLPH | $e^+e^- \rightarrow Z$ |
| $1.29^{+0.24}_{-0.22} \pm 0.06$ | | 5 ACKERSTAFF | 98G OPAL | $e^+e^- \rightarrow Z$ |
| $1.20 \pm 0.08 \pm 0.06$ | | 6 BARATE | 98D ALEP | $e^+e^- \rightarrow Z$ |
| 1.21 ± 0.11 | | 5 BARATE | 98D ALEP | $e^+e^- \rightarrow Z$ |
| $1.32 \pm 0.15 \pm 0.07$ | | 7 ABE | 96M CDF | $p\bar{p}$ at 1.8 TeV |
| $1.46^{+0.22}_{-0.21} \pm 0.07 \pm 0.09$ | | ABREU | 96D DLPH | Repl. by ABREU 99W |
| $1.10^{+0.19}_{-0.17} \pm 0.09$ | | 5 ABREU | 96D DLPH | $e^+e^- \rightarrow Z$ |
| $1.16 \pm 0.11 \pm 0.06$ | | 5 AKERS | 96 OPAL | $e^+e^- \rightarrow Z$ |
| $1.27^{+0.35}_{-0.29} \pm 0.09$ | | ABREU | 95S DLPH | Repl. by ABREU 99W |
| $1.05^{+0.12}_{-0.11} \pm 0.09$ | 290 | BUSKULIC | 95L ALEP | Repl. by BARATE 98D |
| $1.04^{+0.48}_{-0.38} \pm 0.10$ | 11 | 8 ABREU | 93F DLPH | Excess $\Lambda\mu^-$, decay lengths |
| $1.05^{+0.23}_{-0.20} \pm 0.08$ | 157 | 9 AKERS | 93 OPAL | Excess $\Lambda\ell^-$, decay lengths |
| $1.12^{+0.32}_{-0.29} \pm 0.16$ | 101 | 10 BUSKULIC | 92I ALEP | Excess $\Lambda\ell^-$, impact parameters |

¹ Measured mean life using fully reconstructed $\Lambda_b^0 \rightarrow J/\psi \Lambda$ decays.

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

³ Measured using $p\ell^-$ decay length.

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

⁵ Measured using $\Lambda_c\ell^-$ and $\Lambda\ell^+\ell^-$.

⁶ Measured using the excess of $\Lambda\ell^-$, lepton impact parameter.

⁷ Measured using $\Lambda_c\ell^-$.

⁸ ABREU 93F superseded by ABREU 96D.

⁹ AKERS 93 superseded by AKERS 96.¹⁰ BUSKULIC 92I superseded by BUSKULIC 95L.

***b*-baryon ADMIXTURE DECAY MODES**

($\Lambda_b, \Xi_b, \Omega_b$)

These branching fractions are actually an average over weakly decaying *b*-baryons weighted by their production rates at the LHC, LEP, and Tevatron, branching ratios, and detection efficiencies. They scale with the *b*-baryon production fraction $B(b \rightarrow b\text{-baryon})$.

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."

For inclusive branching fractions, *e.g.*, $B \rightarrow D^\pm \text{ anything}$, the values usually are multiplicities, not branching fractions. They can be greater than one.

| Mode | Fraction (Γ_i/Γ) | Scale factor |
|---|--------------------------------|--------------|
| Γ_1 $p\mu^- \bar{\nu}$ anything | $(5.8_{-2.0}^{+2.3})\%$ | |
| Γ_2 $p\ell \bar{\nu}_\ell$ anything | $(5.6 \pm 1.2)\%$ | |
| Γ_3 p anything | $(70 \pm 22)\%$ | |
| Γ_4 $\Lambda \ell^- \bar{\nu}_\ell$ anything | $(3.8 \pm 0.6)\%$ | |
| Γ_5 $\Lambda \ell^+ \nu_\ell$ anything | $(3.2 \pm 0.8)\%$ | |
| Γ_6 Λ anything | $(39 \pm 7)\%$ | |
| Γ_7 $\Xi^- \ell^- \bar{\nu}_\ell$ anything | $(4.6 \pm 1.4) \times 10^{-3}$ | 1.2 |

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

| $\Gamma(p\mu^- \bar{\nu} \text{ anything})/\Gamma_{\text{total}}$ | | | | | Γ_1/Γ |
|---|------|--------------------|----------|------------------------|-------------------|
| VALUE (%) | EVTS | DOCUMENT ID | TECN | COMMENT | |
| $5.8_{-1.9}^{+2.2} \pm 0.8$ | 125 | ¹ ABREU | 95S DLPH | $e^+e^- \rightarrow Z$ | |

¹ ABREU 95S reports $[\Gamma(b\text{-baryon} \rightarrow p\mu^- \bar{\nu} \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = 0.0049 \pm 0.0011_{-0.0011}^{+0.0015}$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

| $\Gamma(p\ell \bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}$ | | | | | Γ_2/Γ |
|---|---------------------|----------|------------------------|--|-------------------|
| VALUE (%) | DOCUMENT ID | TECN | COMMENT | | |
| $5.6 \pm 0.9 \pm 0.7$ | ¹ BARATE | 98V ALEP | $e^+e^- \rightarrow Z$ | | |

¹ BARATE 98V reports $[\Gamma(b\text{-baryon} \rightarrow p\ell \bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = (4.72 \pm 0.66 \pm 0.44) \times 10^{-3}$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\rho\ell\bar{\nu}_\ell \text{ anything})/\Gamma(\rho \text{ anything})$ Γ_2/Γ_3

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|--------------------|-------------|----------|------------------------|
| 8.0±1.2±1.4 | 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 |
|---|------|-----------------------|----------|--|
| 3.8±0.6 OUR AVERAGE | | | | |
| 3.9±0.5±0.5 | | ¹ BARATE | 98D ALEP | $e^+e^- \rightarrow Z$ |
| 3.5±0.4±0.5 | | ² AKERS | 96 OPAL | Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$ |
| 3.6±0.9±0.5 | 262 | ³ ABREU | 95S DLPH | Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$ |
| 7.3±1.4±1.0 | 290 | ⁴ BUSKULIC | 95L ALEP | Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| seen | 157 | ⁵ AKERS | 93 OPAL | Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$ |
| 8.3±2.5±1.1 | 101 | ⁶ BUSKULIC | 92I ALEP | Excess of $\Lambda\ell^-$ over $\Lambda\ell^+$ |

¹ BARATE 98D reports $[\Gamma(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = 0.00326 \pm 0.00016 \pm 0.00039$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Measured using the excess of $\Lambda\ell^-$, lepton impact parameter.

² AKERS 96 reports $[\Gamma(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = 0.00291 \pm 0.00023 \pm 0.00025$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABREU 95S reports $[\Gamma(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = 0.0030 \pm 0.0006 \pm 0.0004$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ BUSKULIC 95L reports $[\Gamma(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = 0.0061 \pm 0.0006 \pm 0.0010$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ AKERS 93 superseded by AKERS 96.

⁶ BUSKULIC 92I reports $[\Gamma(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = 0.0070 \pm 0.0010 \pm 0.0018$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. 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.

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

| VALUE (units 10^{-2}) | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-------------|----------|------------------------|
| 8.0±1.2±0.8 | ABBIENDI | 99L OPAL | $e^+e^- \rightarrow Z$ |

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

| | | | |
|-------------|------------|----------|-----------------------|
| 7.0±1.2±0.7 | ACKERSTAFF | 97N OPAL | Repl. by ABBIENDI 99L |
|-------------|------------|----------|-----------------------|

$\Gamma(\Lambda \text{ anything})/\Gamma_{\text{total}}$ Γ_6/Γ

| VALUE (%) | DOCUMENT ID | TECN | COMMENT |
|-----------|-------------|------|---------|
|-----------|-------------|------|---------|

39 ± 7 OUR AVERAGE42 ± 6 ± 5 ¹ ABBIENDI 99L OPAL e⁺e⁻ → Z27⁺¹⁵₋₉ ± 3 ² ABREU 95C DLPH e⁺e⁻ → Z

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

47 ± 7 ± 6 ³ ACKERSTAFF 97N OPAL Repl. by ABBIENDI 99L

¹ ABBIENDI 99L reports $[\Gamma(b\text{-baryon} \rightarrow \Lambda \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = 0.035 \pm 0.0032 \pm 0.0035$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABREU 95C reports $0.28^{+0.17}_{-0.12}$ from a measurement of $[\Gamma(b\text{-baryon} \rightarrow \Lambda \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})]$ assuming $B(\bar{b} \rightarrow b\text{-baryon}) = 0.08 \pm 0.02$, which we rescale to our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ACKERSTAFF 97N reports $[\Gamma(b\text{-baryon} \rightarrow \Lambda \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = 0.0393 \pm 0.0046 \pm 0.0037$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(\Xi^- \ell^- \bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}$ Γ_7/Γ

| VALUE (units 10 ⁻³) | DOCUMENT ID | TECN | COMMENT |
|---------------------------------|-------------|------|---------|
|---------------------------------|-------------|------|---------|

4.6 ± 1.4 OUR AVERAGE Error includes scale factor of 1.2.3.6 ± 1.2 ± 0.5 ¹ ABDALLAH 05C DLPH e⁺e⁻ → Z⁰6.4 ± 1.6 ± 0.8 ² BUSKULIC 96T ALEP Excess $\Xi^- \ell^-$ over $\Xi^- \ell^+$

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

7.0 ± 2.8 ± 0.9 ³ ABREU 95V DLPH Repl. by ABDALLAH 05C

¹ ABDALLAH 05C reports $[\Gamma(b\text{-baryon} \rightarrow \Xi^- \ell^- \bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = (3.0 \pm 1.0 \pm 0.3) \times 10^{-4}$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BUSKULIC 96T reports $[\Gamma(b\text{-baryon} \rightarrow \Xi^- \ell^- \bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = (5.4 \pm 1.1 \pm 0.8) \times 10^{-4}$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABREU 95V reports $[\Gamma(b\text{-baryon} \rightarrow \Xi^- \ell^- \bar{\nu}_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(\bar{b} \rightarrow b\text{-baryon})] = (5.9 \pm 2.1 \pm 1.0) \times 10^{-4}$ which we divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (8.4 \pm 1.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

| | | | | |
|------------|-----|---------------|----------------------------|------------------|
| ABAZOV | 12U | PR D85 112003 | V.M. Abazov <i>et al.</i> | (D0 Collab.) |
| ABAZOV | 07S | PRL 99 142001 | V.M. Abazov <i>et al.</i> | (D0 Collab.) |
| ABAZOV | 05C | PRL 94 102001 | V.M. Abazov <i>et al.</i> | (D0 Collab.) |
| ABDALLAH | 05C | EPJ C44 299 | J. Abdallah <i>et al.</i> | (DELPHI Collab.) |
| 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.) |
| ACKERSTAFF | 98G | PL B426 161 | K. Akerstaff <i>et al.</i> | (OPAL 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.) |
| ABE | 96M | PRL 77 1439 | F. Abe <i>et al.</i> | (CDF 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.) |
