Λ_b^0

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

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

Λ_b^0 MASS

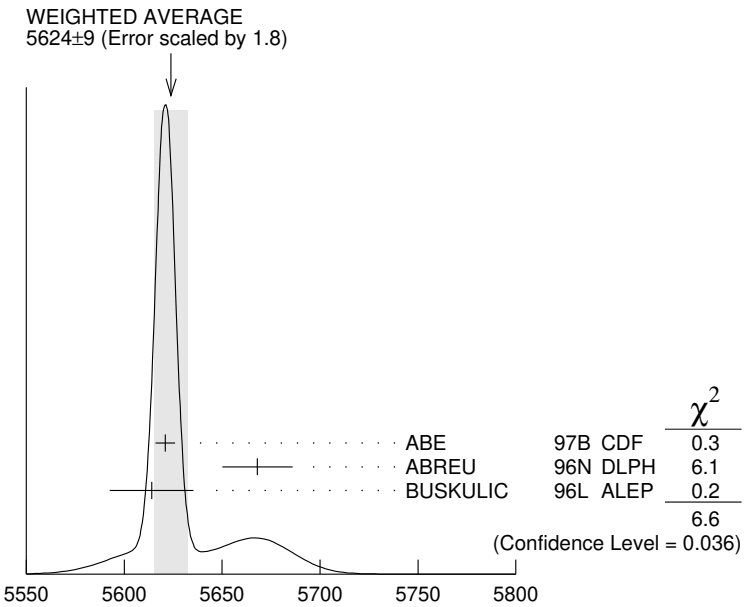
VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
5624± 9 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.			
5621± 4± 3		[1] ABE	97B	CDF	$p\overline{p}$ at 1.8 TeV
5668± 16± 8	4	[2] ABREU	96N	DLPH	$e^+e^- \rightarrow Z$
5614± 21± 4	4	[2] BUSKULIC	96L	ALEP	$e^+e^- \rightarrow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

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

[2] Uses 4 fully reconstructed Λ_b events.

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

[4] ALBAJAR 91E claims 16 ± 5 events above a background of 9 ± 1 events, a significance of about 5 standard deviations.



Λ_b^0 mass (MeV)

Λ_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 Λ_b^0, with some Ξ_b^0 and Ξ_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*
$1.11^{+0.13}_{-0.12}$ OUR EVALUATION				
$1.32 \pm 0.15 \pm 0.07$		ABE	96M CDF	Excess $\Lambda_c \ell^-$, decay lengths
$1.19^{+0.21}_{-0.18}{}^{+0.07}_{-0.08}$		ABREU	96D DLPH	Excess $\Lambda_c \ell^-$, decay lengths
$1.14^{+0.22}_{-0.19} \pm 0.07$	69	AKERS	95K OPAL	Excess $\Lambda_c \ell^-$, decay lengths
$1.02^{+0.23}_{-0.18} \pm 0.06$	44	BUSKULIC	95L ALEP	Excess $\Lambda_c \ell^-$, decay lengths

Λ_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 $p\overline{p}$), branching ratios, and detection efficiencies. They scale with the LEP Λ_b production fraction $B(b \to \Lambda_b)$ and are evaluated for our value $B(b \to \Lambda_b) = (13.2 \pm 4.1)\%$.

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

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	$J/\psi(1S)\Lambda$	$(3.4 \pm 2.1) \times 10^{-4}$	
Γ_2	$p D^0 \pi^-$	seen	
Γ_3	$\Lambda_c^+ \pi^-$	seen	
Γ_4	$\Lambda_c^+ a_1(1260)^-$	seen	
Γ_5	$\Lambda_c^+ \pi^+ \pi^- \pi^-$	seen	
Γ_6	$\Lambda K^0 2\pi^+ 2\pi^-$		
Γ_7	$\Lambda_c^+ \ell^- \overline{\nu}_\ell$ anything	[a] (10 ± 4) %	
Γ_8	$p\pi^-$	$< 5.0 \times 10^{-5}$	90%
Γ_9	pK^-	$< 5.0 \times 10^{-5}$	90%

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

Λ_b^0 BRANCHING RATIOS

$\Gamma(J/\psi(1S)\Lambda)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (units 10^{-4})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3.4± 1.7± 1.2		[5] ABE	97B	CDF	$p\overline{p}$ at 1.8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
136.4±83.3±42.4	16	[6] ALBAJAR	91E	UA1	$J/\psi(1S) \to \mu^+ \mu^-$

[5] ABE 97B reports (0.037 ± 0.017(stat)±0.007(sys))% for $B(b \to \Lambda_b) = 0.1$ and for $B(b \to J/\psi(1S) K_S^0) = 0.037\%$. We rescale to our PDG 97 best value $B(b \to \Lambda_b) = (13.2 \pm 4.1)\%$ and $B(b \to J/\psi(1S) K_S^0) = (0.044 \pm 0.0085)\%$. Our first error is their experiments's error and our second error is the systematic error from using our best value.

[6] ALBAJAR 91E reports 180 ± 110 for $B(b \to \Lambda_b) = 0.10$. We rescale to our best value $B(b \to \Lambda_b) = (13.2 \pm 4.1) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(p D^0 \pi^-)/\Gamma_{total}$ Γ_2/Γ

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

$\Gamma(\Lambda_c^+ \pi^-)/\Gamma_{total}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	3	ABREU	96N	DLPH	$\Lambda_c^+ \to p K^- \pi^+$
seen	4	BUSKULIC	96L	ALEP	$\Lambda_c^+ \to p K^- \pi^+$, $p \overline{K}^0$, $\Lambda \pi^+ \pi^+ \pi^-$

$\Gamma(\Lambda_c^+ a_1(1260)^-)/\Gamma_{total}$ Γ_4/Γ

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

$\Gamma(\Lambda_c^+ \pi^+ \pi^- \pi^-)/\Gamma_{total}$ Γ_5/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	90	BARI	91	SFM	$\Lambda_c^+ \to p K^- \pi^+$

$\Gamma(\Lambda K^0 2\pi^+ 2\pi^-)/\Gamma_{total}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	4	[7] ARENTON	86	FMPS	$\Lambda K_S^0 2\pi^+ 2\pi^-$

[7] See the footnote to the ARENTON 86 mass value.

$\Gamma(\Lambda_c^+ \ell^- \overline{\nu}_\ell \text{anything})/\Gamma_{total}$ Γ_7/Γ

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.10 ±0.04 OUR AVERAGE					
$0.089^{+0.031}_{-0.025} \pm 0.028$	29	[8] ABREU	95S	DLPH	$e^+ e^- \to Z$
0.11 ±0.03 ±0.04	55	[9] BUSKULIC	95L	ALEP	$e^+ e^- \to Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.23 ±0.09 ±0.07	21	[10] BUSKULIC	92E	ALEP	$\Lambda_c^+ \to p K^- \pi^+$

[8] ABREU 95S reports [B($\Lambda_b^0 \to \Lambda_c^+ \ell^- \overline{\nu}_\ell$ anything) × B($b \to \Lambda_b$)] = 0.0118 ± $0.0026^{+0.0031}_{-0.0021}$. We divide by our best value B($b \to \Lambda_b$) = (13.2 ± 4.1) × 10^{-2}. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[9] BUSKULIC 95L reports [B($\Lambda_b^0 \to \Lambda_c^+ \ell^- \overline{\nu}_\ell$ anything) × B($b \to \Lambda_b$)] = 0.0151 ± 0.0029 ± 0.0023. We divide by our best value B($b \to \Lambda_b$) = (13.2 ± 4.1) × 10^{-2}. Our

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

[10] BUSKULIC 92E reports $[B(\Lambda_b^0 \to \Lambda_c^+ \ell^- \overline{\nu}_\ell \text{ anything}) \times B(b \to \Lambda_b)] = 0.030 \pm 0.007 \pm 0.009$. We divide by our best value $B(b \to \Lambda_b) = (13.2 \pm 4.1) \times 10^{-2}$. 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.

$\Gamma(p\pi^-)/\Gamma_{total}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<5.0 \times 10^{-5}$	90	[11] BUSKULIC	96V	ALEP	$e^+ e^- \to Z$

[11] BUSKULIC 96V assumes PDG 96 production fractions for B^0, B^+, B_s, b baryons.

$\Gamma(pK^-)/\Gamma_{total}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<5.0 \times 10^{-5}$	90	[12] BUSKULIC	96V	ALEP	$e^+ e^- \to Z$

[12] BUSKULIC 96V assumes PDG 96 production fractions for B^0, B^+, B_s, b baryons.

Λ_b^0 REFERENCES

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.)
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.)