Ξ_b^0

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$ Status: ***
I, J, P need confirmation.

In the quark model, Ξ_b^0 and Ξ_b^- are an isodoublet (*usb*, *dsb*) state; the lowest Ξ_b^0 and Ξ_b^- ought to have $J^P = 1/2^+$. None of I, J, or P have actually been measured.

Ξ_b^0 MASS

Ξ_b^0 MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
5791.9 ±0.5 OUR AVERAGE				
5794.3 ±2.4 ±0.7	AAIJ	14H	LHCB	pp at 7 TeV
5791.80±0.39±0.31	[1] AAIJ	14Z	LHCB	pp at 7, 8 TeV
5788.7 ±4.3 ±1.4	[2] AALTONEN	14B	CDF	$p\overline{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5787.8 ±5.0 ±1.3	[3] AALTONEN	11X	CDF	Repl. by AALTONEN 14B

[1] Uses $\Xi_b^0 \to \Xi_c^+ \pi^-$ and $\Xi_c^+ \to p K^- \pi^+$ decays. The measurement comes from the mass difference of Ξ_b^0 and Λ_b^0.

[2] Uses $\Xi_b^0 \to \Xi_c^+ \pi^-$ decays.

[3] Measured in $\Xi_b^0 \to \Xi_c^+ \pi^-$ with $25.3^{+5.6}_{-5.4}$ candidates.

$m_{\Xi_b^0} - m_{\Lambda_b^0}$

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
172.5 ±0.4 OUR AVERAGE				
174.8 ±2.4 ±0.5	AAIJ	14H	LHCB	pp at 7 TeV
172.44±0.39±0.17	[1] AAIJ	14Z	LHCB	pp at 7, 8 TeV

[1] Uses $\Xi_b^0 \to \Xi_c^+ \pi^-$ and $\Xi_c^+ \to p K^- \pi^+$ decays.

Ξ_b^0 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 (HFLAV) and are described at https://hflav.web.cern.ch/. The averaging/rescaling procedure takes into account correlations between the measurements and asymmetric lifetime errors.

Ξ_b^0 MEAN LIFE

VALUE (10^{-12} s)	*DOCUMENT ID*		*TECN*	*COMMENT*
1.480±0.030 OUR EVALUATION				
1.477±0.026±0.019	[1] AAIJ	14Z	LHCB	pp at 7, 8 TeV

[1] Uses $\Xi_b^0 \to \Xi_c^+ \pi^-$ and $\Xi_c^+ \to p K^- \pi^+$ decays. The measurement comes from the value of relative lifetime of Ξ_b^0 to Λ_b^0.

τ_{mix} $(1/2\pi)$ times the oscillation period

VALUE (s)	*DOCUMENT ID*		*TECN*	*COMMENT*
$>13\times10^{-12}$	[1] AAIJ	17BH	LHCB	pp at 7, 8 TeV

[1] Uses Ξ_b^{*-} and $\Xi_b^{\prime-}$ decays to $\Xi_b^0\pi^-$, where $\Xi_b^0\to\ \Xi_c^+\pi^-$, $\Xi_c^+\to\ pK^-\pi^+$.

Ξ_b^0 DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	$pD^0K^-\times$ B($b\to\ \Xi_b^0$)	$(1.7\ \pm0.5\ )\times10^{-6}$	
Γ_2	$p\overline{K}^0\pi^-\times$ B($b\to\ \Xi_b^0$)/B($\overline{b}\to\ B^0$)	$<1.6\times10^{-6}$	90%
Γ_3	$pK^0K^-\times$ B($b\to\ \Xi_b^0$)/B($\overline{b}\to\ B^0$)	$<1.1\times10^{-6}$	90%
Γ_4	$\Lambda\pi^+\pi^-\times$ B($b\to\ \Xi_b^0$)/B($b\to\ \Lambda_b^0$)	$<1.7\times10^{-6}$	90%
Γ_5	$\Lambda K^-\pi^+\times$ B($b\to\ \Xi_b^0$)/B($b\to\ \Lambda_b^0$)	$<8\times10^{-7}$	90%
Γ_6	$\Lambda K^+K^-\times$ B($b\to\ \Xi_b^0$)/B($b\to\ \Lambda_b^0$)	$<3\times10^{-7}$	90%
Γ_7	$J/\psi\Lambda$	seen	
Γ_8	$J/\psi\Xi^0$	seen	
Γ_9	$\Lambda_c^+K^-\times$ B($b\to\ \Xi_b^0$)	$(6\ \ \pm4\ \ )\times10^{-7}$	
Γ_{10}	$pK^-\pi^+\pi^-\times$ B($b\to\ \Xi_b^0$)/B($b\to\ \Lambda_b^0$)	$(1.9\ \pm0.4\ )\times10^{-6}$	
Γ_{11}	$pK^-K^-\pi^+\times$ B($b\to\ \Xi_b^0$)/B($b\to\ \Lambda_b^0$)	$(1.71\pm0.31)\times10^{-6}$	
Γ_{12}	$pK^-K^+K^-\times$ B($b\to\ \Xi_b^0$)/B($b\to\ \Lambda_b^0$)	$(1.7\ \pm1.0\ )\times10^{-7}$	

Ξ_b^0 BRANCHING RATIOS

$\Gamma(pD^0K^-\times$ B$(b\to\ \Xi_b^0))/\Gamma_{total}$ Γ_1/Γ

VALUE (units 10^{-6})	*DOCUMENT ID*		*TECN*	*COMMENT*
1.7±0.4±0.4	[1] AAIJ	14H	LHCB	pp at 7 TeV

[1] AAIJ 14H reports [$\Gamma(\Xi_b\to\ pD^0K^-\times$ B$(\overline{b}\to\ \Xi_b)\ )/\Gamma_{total}$] / [B$(\overline{b}\to\ b$-baryon)] / [B$(\Lambda_b^0\to\ pD^0K^-)$] $=0.44\pm0.09\pm0.06$ which we multiply by our best values B$(\overline{b}\to\ b$-baryon) $=(8.4\pm1.1)\times10^{-2}$, B$(\Lambda_b^0\to\ pD^0K^-)=(4.6\pm0.8)\times10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(p\overline{K}^0\pi^-\times$ B$(b\to\ \Xi_b^0)$/B$(\overline{b}\to\ B^0))/\Gamma_{total}$ Γ_2/Γ

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
$<1.6\times10^{-6}$	90	AAIJ	14Q	LHCB	pp at 7 TeV

$\Gamma(pK^0K^-\times B(b\to\Xi_b^0)/B(\overline{b}\to B^0))/\Gamma_{total}$ Γ_3/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.1\times10^{-6}$	90	AAIJ	14Q	LHCB	pp at 7 TeV

$\Gamma(\Lambda\pi^+\pi^-\times B(b\to\Xi_b^0)/B(b\to\Lambda_b^0))/\Gamma_{total}$ Γ_4/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.7\times10^{-6}$	90	AAIJ	16W	LHCB	pp at 7, 8 TeV

$\Gamma(\Lambda K^-\pi^+\times B(b\to\Xi_b^0)/B(b\to\Lambda_b^0))/\Gamma_{total}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<0.8\times10^{-6}$	90	AAIJ	16W	LHCB	pp at 7, 8 TeV

$\Gamma(\Lambda K^+K^-\times B(b\to\Xi_b^0)/B(b\to\Lambda_b^0))/\Gamma_{total}$ Γ_6/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<0.3\times10^{-6}$	90	AAIJ	16W	LHCB	pp at 7, 8 TeV

$\Gamma(J/\psi\Lambda)/\Gamma(J/\psi\Xi^0)$ Γ_7/Γ_8

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
$8.2\pm2.1\pm0.9$	[1] AAIJ	20U	LHCB	pp at 7, 8 and 13 TeV

[1] The Cabibbo suppressed $\Xi_b\to J/\psi\Lambda$ decay is observed for the first time.

$\Gamma(\Lambda_c^+K^-\times B(b\to\Xi_b^0))/\Gamma(pD^0K^-\times B(b\to\Xi_b^0))$ Γ_9/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
$0.36\pm0.19\pm0.02$	[1] AAIJ	14H	LHCB	pp at 7 TeV

[1] AAIJ 14H reports $[\Gamma(\Xi_b\to\Lambda_c^+K^-\times B(\overline{b}\to\Xi_b))/\Gamma(\Xi_b\to pD^0K^-\times B(\overline{b}\to\Xi_b))]\times[B(\Lambda_c^+\to pK^-\pi^+)]\ /\ [B(D^0\to K^-\pi^+)] = 0.57\pm0.22\pm0.21$ which we multiply or divide by our best values $B(\Lambda_c^+\to pK^-\pi^+) = (6.28\pm0.32)\times10^{-2}$, $B(D^0\to K^-\pi^+) = (3.947\pm0.030)\times10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(pK^-\pi^+\pi^-\times B(b\to\Xi_b^0)/B(b\to\Lambda_b^0))/\Gamma_{total}$ Γ_{10}/Γ

VALUE (units 10^{-6})	DOCUMENT ID		TECN	COMMENT
$1.90\pm0.35\pm0.17$	[1] AAIJ	18Q	LHCB	pp at 7, 8 TeV

[1] AAIJ 18Q reports $[\Gamma(\Xi_b\to pK^-\pi^+\pi^-\times B(b\to\Xi_b^0)/B(b\to\Lambda_b^0))/\Gamma_{total}]\ /\ [B(\Lambda_c^+\to pK^-\pi^+)]\ /\ [B(\Lambda_b^0\to\Lambda_c^+\pi^-)] = (6.2\pm0.8\pm0.2\pm0.8)\times10^{-3}$ which we multiply by our best values $B(\Lambda_c^+\to pK^-\pi^+) = (6.28\pm0.32)\times10^{-2}$, $B(\Lambda_b^0\to\Lambda_c^+\pi^-) = (4.9\pm0.4)\times10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(pK^-K^-\pi^+\times B(b\to\Xi_b^0)/B(b\to\Lambda_b^0))/\Gamma_{total}$ Γ_{11}/Γ

VALUE (units 10^{-6})	DOCUMENT ID		TECN	COMMENT
$1.71\pm0.27\pm0.15$	[1] AAIJ	18Q	LHCB	pp at 7, 8 TeV

[1] AAIJ 18Q reports $[\Gamma(\Xi_b\to pK^-K^-\pi^+\times B(b\to\Xi_b^0)/B(b\to\Lambda_b^0))/\Gamma_{total}]\ /\ [B(\Lambda_c^+\to pK^-\pi^+)]\ /\ [B(\Lambda_b^0\to\Lambda_c^+\pi^-)] = (5.6\pm0.6\pm0.4\pm0.5)\times10^{-3}$ which we multiply by our best values $B(\Lambda_c^+\to pK^-\pi^+) = (6.28\pm0.32)\times10^{-2}$, $B(\Lambda_b^0\to$

$\Lambda_c^+ \pi^-) = (4.9 \pm 0.4) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(pK^-K^+K^-) \times B(b \to \Xi_b^0)/B(b \to \Lambda_b^0))/\Gamma_{total}$ Γ_{12}/Γ

VALUE (units 10^{-6})	*DOCUMENT ID*		*TECN*	*COMMENT*
0.17±0.09±0.02	[1,2] AAIJ	18Q	LHCB	pp at 7, 8 TeV

[1] AAIJ 18Q reports $[\Gamma(\Xi_b \to pK^-K^+K^-) \times B(b \to \Xi_b^0)/B(b \to \Lambda_b^0))/\Gamma_{total}]$ / $[B(\Lambda_c^+ \to pK^-\pi^+)]$ / $[B(\Lambda_b^0 \to \Lambda_c^+\pi^-)] = (0.57 \pm 0.28 \pm 0.08 \pm 0.10) \times 10^{-3}$ which we multiply by our best values $B(\Lambda_c^+ \to pK^-\pi^+) = (6.28 \pm 0.32) \times 10^{-2}$, $B(\Lambda_b^0 \to \Lambda_c^+\pi^-) = (4.9 \pm 0.4) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[2] AAIJ 18Q sees excess with a significance of 2.3σ. Using $B(\Lambda_b^0 \to \Lambda_c^+\pi^-) = (0.430 \pm 0.036) \times 10^{-2}$ and $B(\Lambda_c^+ \to pK^-\pi^+) = (6.46 \pm 0.24) \times 10^{-2}$ the authors set two sided limit [0.11–0.25] at 90% C.L.

P AND *CP* VIOLATION ASYMMETRIES

$a_P(\Xi_b^0 \to pK^-K^-\pi^+)$

Observable calculated as average of the triple products for Ξ_b^0 and $\overline{\Xi}_b^0$, which is sensitive to parity violation.

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
−3.04±5.19±0.36	[1] AAIJ	18AG	LHCB	pp at 7, 8 TeV

[1] Measured over full phase space of the decay.

$a_{CP}(\Xi_b^0 \to pK^-K^-\pi^+)$

Observable calculated as half of the difference between triple products for Ξ_b^0 and $\overline{\Xi}_b^0$, which is sensitive to *CP* violation.

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
−3.58±5.19±0.36	[1] AAIJ	18AG	LHCB	pp at 7, 8 TeV

[1] Measured over full phase space of the decay.

$\Delta A_{CP}(\Xi_b^0 \to pK^-\pi^+\pi^-)$

$\Delta A_{CP} \equiv A_{CP}(\Xi_b^0 \to pK^-\pi^+\pi^-) - A_{CP}(\Xi_b^0 \to (\Xi_c^+ \to pK^-\pi^+)\pi^-)$

VALUE (units 10^{-2})	*DOCUMENT ID*		*TECN*	*COMMENT*
−17±11±1	[1] AAIJ	19AH	LHCB	pp at 7 and 8 TeV

[1] Full phase space.

$\Delta A_{CP}(\Xi_b^0 \to pK^-\pi^+K^-)$

$\Delta A_{CP} \equiv A_{CP}(\Xi_b^0 \to pK^-\pi^+K^-) - A_{CP}(\Xi_b^0 \to (\Xi_c^+ \to pK^-\pi^+)\pi^-)$

VALUE (units 10^{-2})	*DOCUMENT ID*		*TECN*	*COMMENT*
−6.8±8.0±0.8	[1] AAIJ	19AH	LHCB	pp at 7 and 8 TeV

[1] Full phase space.

Ξ_b^0 REFERENCES

AAIJ	20U	PRL 124 111802	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	19AH	EPJ C79 745	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	18AG	JHEP 1808 039	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	18Q	JHEP 1802 098	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	17BH	PRL 119 181807	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	16W	JHEP 1605 081	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	14H	PR D89 032001	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	14Q	JHEP 1404 087	R. Aaij *et al.*	(LHCb Collab.)
AAIJ	14Z	PRL 113 032001	R. Aaij *et al.*	(LHCb Collab.)
AALTONEN	14B	PR D89 072014	T. Aaltonen *et al.*	(CDF Collab.)
AALTONEN	11X	PRL 107 102001	T. Aaltonen *et al.*	(CDF Collab.)