b

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

Charge $= -\frac{1}{3}\ e$ Bottom $= -1$

b-QUARK MASS

The b-quark mass is estimated from bottomonium and B masses. It corresponds to the "running" mass m_b ($\mu = m_b$) in the $\overline{\text{MS}}$ scheme. We have converted masses in other schemes to the $\overline{\text{MS}}$ scheme using two-loop QCD pertubation theory with $\alpha_s(\mu{=}m_b) = 0.22$. The range 4.0–4.5 GeV for the $\overline{\text{MS}}$ mass corresponds to 4.6–5.1 GeV for the pole mass (see the "Note on Quark Masses").

VALUE (GeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
4.0 to 4.5 OUR EVALUATION				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.346 ± 0.070	[1] PENIN	02	THEO	$\overline{\text{MS}}$ scheme
3.95 ± 0.57	[2] ABBIENDI	01S	OPAL	$\overline{\text{MS}}$ scheme
4.21 ± 0.05	[3] KUHN	01	THEO	$\overline{\text{MS}}$ scheme
4.05 ± 0.06	[4] NARISON	01B	THEO	$\overline{\text{MS}}$ scheme
$4.210 \pm 0.090 \pm 0.025$	[5] PINEDA	01	THEO	$\overline{\text{MS}}$ scheme
4.7 ± 0.74	[6] BARATE	00V	ALEP	$\overline{\text{MS}}$ scheme
4.20 ± 0.06	[7] HOANG	00	THEO	$\overline{\text{MS}}$ scheme
$4.437^{+0.045}_{-0.029}$	[8] LUCHA	00	THEO	$\overline{\text{MS}}$ scheme
$4.454^{+0.045}_{-0.029}$	[8] PINEDA	00	THEO	$\overline{\text{MS}}$ scheme
4.25 ± 0.08	[9] BENEKE	99	THEO	$\overline{\text{MS}}$ scheme
$3.8\ ^{+0.77}_{-2.0}$	[10] BRANDENB...	99		$\overline{\text{MS}}$ scheme
4.25 ± 0.09	[11] HOANG	99	THEO	$\overline{\text{MS}}$ scheme
4.2 ± 0.1	[12] MELNIKOV	99	THEO	$\overline{\text{MS}}$ scheme
4.21 ± 0.11	[13] PENIN	99	THEO	$\overline{\text{MS}}$ scheme
3.91 ± 0.67	[14] ABREU	98I	DLPH	$\overline{\text{MS}}$ scheme
4.14 ± 0.04	[15] KUEHN	98	THEO	$\overline{\text{MS}}$ scheme
$4.15 \pm 0.05 \pm 0.20$	[16] GIMENEZ	97	LATT	$\overline{\text{MS}}$ scheme
4.19 ± 0.06	[17] JAMIN	97	THEO	$\overline{\text{MS}}$ scheme
$4.16 \pm 0.32 \pm 0.60$	[18] RODRIGO	97	THEO	$\overline{\text{MS}}$ scheme

[1] PENIN 02 determines m_b from the spectrum of the Υ system.

[2] ABBIENDI 01S find m_b (M_Z) to be 2.67 ± 0.4 GeV from an analysis of $Z \to b$ decays.

[3] KUHN 01 uses an analysis of the $e^+ e^-$ total cross section to hadrons.

[4] NARISON 01B uses pseudoscalar sum rules in the B and D meson channels.

[5] PINEDA 01 uses the $\Upsilon(1S)$ system to determine the quark mass. The errors are due to theory, and the uncertainty in α_s.

[6] BARATE 00V obtain the b quark mass $m_b(M_Z) = 3.27 \pm 0.22$(stat) ± 0.22(exp) ± 0.38(had) ± 0.16(thy) from an analysis of event shape variables in Z decays. We have converted this to $\mu{=}m_b$.

[7] HOANG 00 uses a NNLO calculation of the vacuum polarization function to determine spectral moments of the masses and electronic decay widths of the Υ mesons.

[8] LUCHA 00, PINEDA 00 obtain the b-quark mass from a perturbative calculation of the Υ spectrum and decay widths to order α_s^4.

[9] BENEKE 99 uses a calculation of the $b\overline{b}$ production cross section and the mass of the Υ meson at NNLO.

[10] BRANDENBURG 99 obtain a b-quark mass of $m_b(M_Z) = 2.56 \pm 0.27 \,^{+0.28}_{-0.38} \,^{+0.49}_{-1.48}$ from a study of three-jet events at the Z. We have converted this to $\mu = m_b$.

[11] HOANG 99 uses a NNLO calculation of the vacuum polarization function to determine spectral moments of the masses and electronic decay widths of the Υ mesons.

[12] MELNIKOV 99 compute the quark mass using Υ sum rules at NNLO.

[13] PENIN 99 compute the quark mass using Υ sum rules at NNLO.

[14] ABREU 98I determines the $\overline{\rm MS}$ mass $m_b = 2.67 \pm 0.25 \pm 0.34 \pm 0.27$ GeV at $\mu = M_Z$ from three jet heavy quark production at LEP. ABREU 98I have rescaled the result to $\mu = m_b$ using $\alpha_s = 0.118 \pm 0.003$.

[15] KUEHN 98 uses a calculation of the vacuum polarization function, including resumming threshold effects, to determine spectral moments of the masses of the Υ mesons. We have converted their extracted value of 4.75 ± 0.04 for the pole mass to the $\overline{\rm MS}$ scheme.

[16] GIMENEZ 97 uses lattice computations of the B-meson propagator and the B-meson binding energy $\overline{\Lambda}$ in the HQET. Their systematic (second) error for the $\overline{\rm MS}$ mass is an estimate of the effects of higher-order corrections in the matching of the HQET operators (renormalon effects).

[17] JAMIN 97 apply the QCD moment method to the Υ system. They also find a pole mass of 4.60 ± 0.02.

[18] RODRIGO 97 determines the $\overline{\rm MS}$ mass $m_b = 2.85 \pm 0.22 \pm 0.20 \pm 0.36$ GeV at $\mu = M_Z$ from three jet heavy quark production at LEP. We have rescaled the result.

b-QUARK REFERENCES

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KUHN	01	NP B619 588	J.H. Kuhn, M. Steinhauser	
NARISON	01B	PL B520 115	S. Narison	
PINEDA	01	JHEP 0106 022	A. Pineda	
BARATE	00V	EPJ C18 1	R. Barate *et al.*	(ALEPH Collab.)
HOANG	00	PR D61 034005	A.H .Hoang	
LUCHA	00	PR D62 097501	W. Lucha, F.F. Schoeberl	
PINEDA	00	PR D61 077505	A. Pineda, F.J. Yndurain	
BENEKE	99	PL B471 233	M. Beneke, A. Signer	
BRANDENB...	99	PL B468 168	A. Brandenburg *et al.*	
HOANG	99	PR D59 014039	A.H. Hoang	
MELNIKOV	99	PR D59 114009	K. Melnikov, A. Yelkhovsky	
PENIN	99	NP B549 217	A.A. Penin, A.A. Pivovarov	
ABREU	98I	PL B418 430	P. Abreu *et al.*	(DELPHI Collab.)
KUEHN	98	NP B534 356	J.H. Kuehn, A.A. Penin, A.A. Pivovarov	
GIMENEZ	97	PL B393 124	V. Gimenez, G. Martinelli, C.T. Sachrajda	
JAMIN	97	NP B507 334	M. Jamin, A. Pich	
RODRIGO	97	PRL 79 193	G. Rodrigo, A. Santamaria, M.S. Bilenky	