INDIRECT MASS LIMITS for *t* Quark from Standard Model Electroweak Fit

The RVUE values are based on the data described in the footnotes. Earlier RVUE's are superseded but have been left in the Listings to show the progress.

"OUR EVALUATION" below is for our fit to electroweak data described in the "Standard Model of Electroweak Interactions" section. This fit result does not include direct measurements of m_t. The second error corresponds to m_H=300^{+700}_{-240} GeV.

VALUE (GeV)	CL%	DOCUMENT ID	TECN	COMMENT
$\mathbf{169^{+16}_{-18}{}^{+17}_{-20}}$ **OUR EVALUATION**				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$157^{+36}_{-48}{}^{+19}_{-20}$		[19] ABREU	94 DLPH	Z parameters
$158^{+32}_{-40}\pm19$		[20] ACCIARRI	94 L3	Z parameters
$132^{+41}_{-48}{}^{+24}_{-18}$		[21] AKERS	94 OPAL	Z parameters
$184^{+25}_{-29}{}^{+17}_{-18}$		[22] BUSKULIC	94 ALEP	Z parameters
140^{+21}_{-22}		[23] ELLIS	94 RVUE	Electroweak
$91\pm46\pm\ 9$		[24] ACTON	93D OPAL	Z parameters
$152^{+36}_{-46}\pm20$		[25] ADRIANI	93M L3	Z parameters
<207	95	[26] ALTARELLI	93 RVUE	$Zb\overline{b}$ vertex
143^{+19}_{-18}		[27] BLONDEL	93 RVUE	Z parameters
$174^{+27}_{-32}{}^{+17}_{-22}$		[28] BUSKULIC	93J ALEP	Z parameters
<228	95	[29] BUSKULIC	93M ALEP	$\Gamma(Z\to\ b\overline{b})$
132^{+20}_{-22}		[30] ELLIS	93B RVUE	
$102^{+35}_{-32}{}^{+19}_{-18}$		[31] MONTAGNA	93 RVUE	Z parameters
114^{+32}_{-42}		[32] MONTAGNA	93B RVUE	Z parameters
		[33] NOVIKOV	93B RVUE	
$146^{+18}_{-19}\pm17$		[34] PASSARINO	93 RVUE	Electroweak
$147^{+22}_{-26}{}^{+17}_{-22}$		[35] QUAST	93 RVUE	Z parameters
160^{+50}_{-60}		[36] ALITTI	92B UA2	m_W, m_Z
$123^{+33}_{-38}\pm19$		[37] BANERJEE	92 RVUE	Electroweak
<208	95	[38] BLONDEL	92 RVUE	$Zb\overline{b}$ vertex
$170^{+42}_{-55}{}^{+21}_{-14}$		[39,40] DECAMP	92B ALEP	Z parameters
112^{+22}_{-23}		[41] DELAGUILA	92 RVUE	Electroweak
122^{+25}_{-20}		[42] DELAGUILA	92B RVUE	
120^{+27}_{-28}		[43] ELLIS	92 RVUE	Electroweak
124^{+26}_{-28}		[44] ELLIS	92E RVUE	
		[45] LANGACKER	92B RVUE	Z'
$124^{+40}_{-56}\pm21$		[46] LEP	92 RVUE	Z parameters
$132^{+27}_{-31}{}^{+18}_{-19}$		[46] LEP	92 RVUE	Electroweak
$150^{+23}_{-26}\pm16$		[47] PDG	92 RVUE	Electroweak
$137^{+22}_{-25}{}^{+18}_{-22}$		[48] RENTON	92 RVUE	Electroweak
$150^{+29}_{-34}{}^{+20}_{-22}$		[49] SCHAILE	92 RVUE	Z parameters
$144^{+23}_{-26}{}^{+19}_{-21}$		[49] SCHAILE	92 RVUE	Electroweak
<220	95	[50] ABE	91B RVUE	m_W, m_Z
<215	95	[39] ABREU	91F DLPH	Z parameters
$193^{+52}_{-69}\pm16$		[39,51] ADEVA	91E L3	Z parameters
$100^{+70}_{-52}{}^{+24}_{-11}$		[52,53] ALEXANDER	91F OPAL	Z parameters
		[54] DELAGUILA	91C RVUE	Z'
119^{+39}_{-45}		[55] GONZALEZ-G..91	RVUE	Electroweak
134^{+47}_{-48}		[56] HIOKI	91 RVUE	Electroweak
$124^{+28}_{-34}{}^{+20}_{-15}$		[57] LANGACKER	91 RVUE	Electroweak
<366	90	[58] ADACHI	90F RVUE	$\sigma(e^+e^-\to$ hadrons)
<200	95	[59] ADEVA	90I RVUE	Electroweak
<200	95	[60] BARGER	90C RVUE	Electroweak
<240	90	[61] BLONDEL	90 CDHS	$\nu N\to\ \nu X$ or $\overline{\nu}N\to\ \overline{\nu}X$
$120\pm40\pm20$		[62] DECAMP	90P RVUE	Electroweak
127^{+24}_{-30}		[63] ELLIS	90B RVUE	Electroweak
<190	95	[64] KENNEDY	90 RVUE	Electroweak
132^{+31}_{-37}		[65] ELLIS	89B RVUE	Electroweak
140^{+43}_{-52}		[66] LANGACKER	89 RVUE	Electroweak
<168	90	[67] COSTA	88 RVUE	Electroweak
<153	68	[68] ELLIS	88C RVUE	Electroweak
<291	90	[69] FOGLI	88 RVUE	$\nu N\to\ \nu X$
<180	90	[70] AMALDI	87 RVUE	Electroweak

[19] ABREU 94 value is for $\alpha_s(m_Z)$ constrained to 0.123 ± 0.005. The second error corresponds to m_H = 300^{+700}_{-240} GeV.

[20] ACCIARRI 94 value is for $\alpha_s(m_Z)$ constrained to 0.124 ± 0.006. The second error corresponds to m_H = 300^{+700}_{-240} GeV.

[21] AKERS 94 result is from fit with free α_s. The second error corresponds to m_H=300^{+700}_{-240} GeV. The 95%CL limit is m_t <210 GeV.

[22] BUSKULIC 94 result is from fit with free α_s. The second error is from m_H=300^{+700}_{-240} GeV.

[23] ELLIS 94 is fit to electroweak data available in summer 1993. m_t, m_H, and α_s are adjusted to minimize χ^2, yielding m_t above, m_H = 35^{+205}_{-26} GeV, and $\alpha_s(m_Z)$ = $0.116^{+0.007}_{-0.006}$.

[24] ACTON 93D result is from fit with free α_s. The second error corresponds to m_H=300^{+700}_{-240} GeV. The 95%CL limit is m_t <180 GeV. Negative statistical error is larger than −46. Superseded by AKERS 94.

[25] ADRIANI 93M used $\alpha_s(m_Z)$=0.124 ± 0.006. Second error corresponds to m_H=50 GeV – 1 TeV. Superseded by ACCIARRI 94.

[26] ALTARELLI 93 limit is from fit to electroweak data available in summer '92 but uses only the parameter corresponding to $Zb\overline{b}$ vertex correction. $\alpha_s(m_Z)$ = 0.118 ± 0.007 is used.

[27] BLONDEL 93 is m_t − m_H fit to LEP data available in spring '93. α_s = 0.117 ± 0.005 is used and m_t >108 GeV, m_H > 62.5 GeV imposed. 95%CL limit is 185 GeV.

[28] BUSKULIC 93J second error is from m_H=300^{+700}_{-250} GeV. Superseded by BUSKULIC 94.

[29] BUSKULIC 93M limit is from $\Gamma(b\overline{b})/\Gamma(\text{had})$ = 0.2193 ± 0.0029. The best value is m_t = 50 ± 70 GeV. The CDF limit m_t >91 GeV is imposed to obtain the limit.

[30] ELLIS 93B fit to electroweak data available in spring '93. m_H is adjusted to minimize χ^2 (even below the present direct limit) and $\alpha_s(m_Z)$ = 0.123 ± 0.006 is used. 95%CL limit of m_t <155 GeV is claimed.

[31] MONTAGNA 93 perform fit to LEP cross-section and asymmetry data taken in 1989/90. The second error corresponds to m_H =300^{+700}_{-235} GeV. Direct limits on m_t, m_H are imposed. α_s is adjusted to minimize χ^2. Updated in MONTAGNA 93B.

[32] MONTAGNA 93B is an update of MONTAGNA 93, including fits to realistic (i.e. with experimental cuts) cross sections and asymmetries. m_Z and α_s are adjusted to minimize χ^2. m_H is fixed at m_H = 300 GeV.

[33] See Fig. 2 of NOVIKOV 93B for χ^2 contour in m_t − m_H plane calculated from m_W, $\Gamma(\ell\ell)$, and $A^{\ell\ell}_{FB}$ data available in summer '92.

[34] PASSARINO 93 fit is to LEP and m_W data available in spring '93. α_s is adjusted to minimize χ^2. The second error is from m_H=300^{+700}_{-240} GeV.

[35] QUAST 93 is fit to LEP data taken up to 1991. α_s is fitted (0.133 ± 0.008 ± 0.002). The second error is from m_H=300^{+700}_{-240} GeV.

[36] ALITTI 92B assume m_H = 100 GeV. The 95%CL limit is m_t < 250 GeV for m_H < 1 TeV.

[37] BANERJEE 92 is a fit to LEP data taken in '90 as well as m_W. The second error is from m_H=300^{+700}_{-250} GeV. $\alpha_s(m_Z)$ = 0.118 ± 0.008 is used. Fit to LEP data only gives m_t = 99 ± 48 ± 22 GeV.

[38] BLONDEL 92 limit is from $\Gamma(b\overline{b})/\Gamma(\text{had})$, $\sin^2\theta^{\text{eff}}_W$ from asymmetries, and $\alpha_s(m_Z)$ = 0.117 ± 0.004 (data available in spring '92). m_t >91 GeV imposed. The limit is sensitive to the value of α_s.

[39] Limit from Z cross sections, leptonic forward-backward asymmetries, τ polarization asymmetry, quark charge asymmetry, and bb and cc forward-backward asymmetries.

[40] DECAMP 92B uses α_s = 0.121 ± 0.008. The second error is from m_{H^0} = 200^{+800}_{-150} GeV. The "Electroweak" value combines ALEPH Z data and m_W/m_Z from ALITTI 90B and ABE 90G.

[41] DELAGUILA 92 is fit to electroweak data including LEP data taken '90. The value is for m_H = 100 GeV, $\alpha_s(m_Z)$ = 0.12 fixed. For m_H = 1 TeV, m_t = 140^{+19}_{-21} GeV.

[42] DELAGUILA 92B perform two-dimensional fit to various electroweak data with direct limits on m_t,m_H.

[43] ELLIS 92 is an update of ELLIS 90B to include the latest LEP, UA2, CDF, and CHARM II results presented at the Lepton-Photon and EPS Conference, July 1991. α_s = 0.115 ± 0.008 assumed and m_H left free. Fit gives 1.3 GeV < m_H < 160 GeV, CL = 68% for m_t = 130 GeV.

[44] ELLIS 92E perform fit to electroweak data available in spring '92. m_H is adjusted to minimize χ^2 and $\alpha_s(m_Z)$ = 0.118 ± 0.008 is used.

[45] LANGACKER 92B consider the effect of an extra Z boson (Z'_{SM}, Z_{LR}, Z_χ, Z_ψ, Z_η) on the top mass determination. The fit including Z' does not change the limit on m_t.

[46] The LEP 92 values are combined results of the four LEP collaborations: ALEPH, DELPHI, L3, and OPAL. The "Electroweak" result includes m_W and m_W/m_Z from ABE 90G and ALITTI 92B, and neutral current data from CDHS and CHARM. Uses α_s = 0.118 ± 0.008. Second error corresponds to m_H = 300^{+700}_{-250} GeV.

[47] PDG 92 value comes from a fit by P. Langacker to recent data as discussed in the minireview above.

[48] RENTON 92 is a fit to LEP data taken up to '90 as well as m_W, νN, and atomic parity violation data. The second error is from m_H=300^{+700}_{-250} GeV. $\alpha_s(m_Z)$ = 0.114 ± 0.007 is used. The 95%CL limit is 193 GeV. The fit to LEP data only gives m_t=142^{+30}_{-37} ± 20 GeV.

[49] SCHAILE 92 performs fit to LEP electroweak data (as of summer 1991) as well as m_W (UA2/CDF) and νN (CDHS/CHARM). The second error is from m_H=300^{+700}_{-250} GeV.

[50] The ABE 91B limit is derived from their m_W with m_Z = 91.161 GeV. Combining with the m_W measurement of ALITTI 90B, one obtains m_t < 230 GeV (95%CL).

[51] α_s = 0.115 ± 0.009. The second error is from m_{H^0} = 300^{+700}_{-250} GeV.

[52] ALEXANDER 91F use α_s = 0.118 ± 0.008. The second error comes from m_H = 300^{+700}_{-250} GeV.