# 1 Aleph Results

( as published until October 1996 )

**Electro-Weak results**

| | ALEPH publ. 89 to 92 | ALEPH prel. 89 to 95 | LEP prel. 89 to 95 |
|---|---|---|---|
| $M_Z$ (GeV) | $91.187 \pm 0.009$ | $91.1873 \pm 0.0030$ | $91.1863 \pm 0.0020$ |
| $\Gamma_Z$ (GeV) | $2.501 \pm 0.012$ | $2.4950 \pm 0.0047$ | $2.4946 \pm 0.0027$ |
| $\sigma^0_{hadrons}$ (nb) | $41.60 \pm 0.16$ | $41.576 \pm 0.083$ | $41.508 \pm 0.056$ |
| $R_l$ | $20.69 \pm 0.09$ | $20.766 \pm 0.049$ | $20.778 \pm 0.029$ |
| $A^{0,l}_{FB}$ | $0.0171 \pm 0.0033$ | $0.0187 \pm 0.0017$ | $0.0174 \pm 0.0010$ |
| $\mathcal{A}_\tau$ | | $0.136 \pm 0.015$ | $0.1401 \pm 0.00674$ |
| $\mathcal{A}_e$ | | $0.129 \pm 0.017$ | $0.1382 \pm 0.0076$ |
| $R_b$ | | $0.2158 \pm 0.0014$ | $0.2179 \pm 0.0012$ |
| $R_c$ | | $0.1683 \pm 0.0091$ | $0.1715 \pm 0.0056$ |
| $A^{0,b}_{FB}$ | | $0.0968 \pm 0.0037$ | $0.0979 \pm 0.0023$ |
| $A^{0,c}_{FB}$ | | $0.081 \pm 0.013$ | $0.0733 \pm 0.0049$ |
| $\sin^2\theta^{eff}_W \langle Q_{FB} \rangle$ | | $0.2322 \pm 0.0013$ | $0.2320 \pm 0.0010$ |
| $\sin^2\theta^{eff}_W$ | $0.2321 \pm 0.0012$ | $0.2319 \pm 0.0005$ | $0.23209 \pm 0.00024$ |
| $N_\nu$ | $2.983 \pm 0.034$ | | $2.989 \pm 0.012$ |
| $M_t$(GeV) | $172 \pm^{20}_{22} \pm^{17}_{18}$ | $178 \pm 12^{+17}_{-19}$ | $171 \pm 8^{+17}_{-19}$ |
| $\alpha_s$ | $0.114 \pm 0.011$ | $0.119 \pm 0.005 \pm 0.002$ | $0.122 \pm 0.003 \pm 0.002$ |
| + SLD, $p\bar{p}$ and $\nu$ | | | |
| $M_t$(GeV) | | | $177 \pm 7^{+16}_{-19}$ |
| $\alpha_s$ | | | $0.121 \pm 0.003 \pm 0.002$ |

**QCD results**

| | | | |
|---|---|---|---|
| Event shape with exponentiation method: | $\alpha_S(M_Z^2) = 0.125 \pm 0.005$ | | |
| Evidence of non abelian gauge: | | measured | SU(3) |
| | $N_F/C_F$ | $2.24 \pm 0.32 \pm 0.24$ | 2.25 |
| | $T_F/C_F$ | $0.58 \pm 0.17 \pm 0.23$ | 0.375 |
| Charged multiplicity: | $< N_{charged} >_{at\ M_Z} = 20.85 \pm 0.24$ | | |
| at $\tau$ mass: | $\alpha_S(M_\tau^2) = 0.330 \pm 0.046$ | | |
| by running to $M_Z$ : | $\alpha_S(M_Z^2) = 0.118 \pm 0.005$ | | |

**$\tau$ results**

$\tau$ lifetime: $\tau_\tau = 0.2937 \pm 0.0027 \pm 0.0016$ ps ( 89 to 92 data)

$\mu - \tau$ universality: $g_\tau / g_\mu = 0.9943 \pm 0.0065$

Inclusive Branching ratios:

| | | | |
|---|---|---|---|
| BR($\tau \to$ 1 charged) | $= 85.45 \pm 0.97\%$ | BR($\tau \to$ 3 h $+\nu_\tau$) | $= 9.5 \pm 0.7\%$ |
| BR($\tau \to$ 3 charged) | $= 14.35 \pm 0.48\%$ | BR($\tau \to$ 1 h $+2\pi^0\nu_\tau$) | $= 10.2 \pm 1.1\%$ |
| BR($\tau \to$ 5 charged) | $= 0.10 \pm 0.05\%$ | | |

Leptonic Branching ratios: (91 to 93 data )

$\mathrm{BR}_e = 17.79 \pm 0.12 \pm 0.06\%$

$\mathrm{BR}_\mu = 17.31 \pm 0.11 \pm 0.05\%$

$\tau$ polarisation: ( 90 to 92 data )

$g_V^\tau/g_A^\tau = 0.073 \pm 0.012$ $\quad g_V^e/g_A^e = 0.060 \pm 0.013$

$A_\tau = 0.136 \pm 0.015$ $\quad A_e = 0.129 \pm 0.017$

$\sin^2\theta_W^{eff} = 0.2332 \pm 0.0014$

$\tau$ neutrino mass limit $< 24$ MeV (95% CL)

## b physics

### Lifetimes:

$\tau_{b-hadrons} = 1.533 \pm 0.013 \pm 0.022$ ps ( 89 to 93 data)

$\tau_{\bar{B}^0} = 1.55 \pm 0.06 \pm 0.03$ ps

$\tau_{B^-} = 1.58 \pm 0.09 \pm 0.03$ ps

$\tau_{\Lambda_b} = 1.04 \pm 0.13$ ps (91 to 93 data )

$\tau_{B_s} = 1.54 \pm 0.14$ ps (91 to 95 data )

$\tau_{\Xi_b} = 1.35^{+0.37+0.15}_{-0.28-0.17}$ ps (91 to 95 data )

Oscillations: $\Delta m_d = 0.436 \pm 0.033 ps^{-1}$ ( 91 to 94 data )

$\Delta m_s > 6.6 ps^{-1}$ ( 91 to 95 data )

### Branching ratios:

$J/\Psi$ production from b: $\mathrm{BR}(b \rightarrow J/\Psi X) = 1.21 \pm 0.13 \pm 0.08\%$

gives $\tau_b = 1.35^{+0.19}_{-0.17} \pm 0.05$ ps

Semi-leptonic decays of $B_s$ and $\Lambda_b$:

$\mathrm{BR}(\bar{b} \rightarrow B_s)\mathrm{BR}(B_s \rightarrow D_s^- l^+ \nu X) = 0.040 \pm 0.011^{+0.010}_{-0.012}$

$\mathrm{BR}(b \rightarrow \Lambda_b)\ \mathrm{BR}(\Lambda_b \rightarrow \Lambda_c^+ l^+ \bar{\nu} X) = 0.030 \pm 0.007 \pm 0.009$

$\mathrm{BR}(b \rightarrow \tau^- \bar{\nu}_\tau X) = 0.0408 \pm 0.0076 \pm 0.0062$

$| V_{cb} |$

$F(1) \mid V_{cb} \mid = (31.4 \pm 2.3 \pm 2.5)10^{-3}$

$\mid V_{cb} \mid = (34.5 \pm 2.5 \pm 2.7)10^{-3}$

Energy fraction for b and c hadrons: $< x >_b = 0.702 \pm 0.004 \pm 0.005$

$< x >_c = 0.508 \pm 0.083 \pm 0.06$

## Searches

| MSM Higgs: | MSSM (h,A) doublet search: |
|---|---|
| $m_{H^0} \geq 63.9$ GeV (at 95% CL) | $m_h \geq 44$ GeV $m_A \geq 21$ GeV |

Compositeness: $m_{e^*} \geq 46.1$ GeV $\quad m_{\mu^*} \geq 46.1$ GeV $\quad m_{\tau^*} \geq 46.0$ GeV

$m_{\nu^*} \geq 47.0$ GeV $\quad m_{q^*} \geq 45.0$ GeV

New weakly interacting particle $X^0$:

assuming BR(Z$\rightarrow l^+l^-X^0$)/ BR(Z$\rightarrow l^+l^-$) $\geq 2.5\ 10^{-3}$,
$m_{X^0} \in [7, 60]$ GeV is excluded at 95 % CL

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