ALEPH 90-82
PHYSIC 90-52
R.E. Carney
5.6.1990

QCD MEETING MINUTES.

31st. MAY 1990.

PRESENT:

Richard E. Carney (Sheffield), Glen Cowan (MPI), Trande Hansl-Kozanecka (MPI), Hongbo HU (Beijing), Eberhard Lange (MPI), Nathalie Lieske (IC), E Locci (Saclay), Thomas Lohse (CERN), Phillip Reeves (Sheffield), Tongze Ruan (Beijing), Rick St.Denis (CERN), D Schlatter (CERN), Ron Settles (MPI-Munich), Ken Smith (Glasgow).

1) R' and α_S Values From '89 And '90 Data. - Eberhard Lange.

Values or R' and α_S for both the '89 and '90 data were presented.

$(\Delta\alpha_S)sys. = \Pi\Delta\sigma_L/\sigma_L \sim 1\%$ (L-lepton).

It was emphasised that $\Delta\alpha_S$ is taken to be the worst case, as all uncertainties in m_t, m_H, m_Z, etc. are taken individually. However, it is felt that there may be some correlation between the values which reduces the effect. Both data sets contain ~ $1Pb^{-1}$ of data.

For common leptons, the sytematic errors are found to be lower than when the leptons are treated individually.

N.B. The error in R' for the '90 data should read 0.950 and not 0.450.

2) Flavour Dependence Of α_S. - Ron Settles.

This idea was prompted by the Tasso analysis, which tested whether the coupling of the gluon to light quarks is not the same as the coupling to heavy quarks.

There was some discussion over whether the ratio $\alpha_S(b)/\alpha_S(all)$ is less sensitive to fragmentation, cuts etc. or not. The paper should be consulted for further details. (Z. Phys. C42(1989)17). It turns out that fragmentation limits the possibility of observing any effect unless it is greater than ~30%.

Another idea considered was whether the dependence could be calculated using R'. However, in conclusion, it was felt that unless we understand b-tagging efficiency and background subtraction more thoroughly, an effect can not be observed. For more improvement in this area we require better vertex detectors.

3) Preparation Of The Next Paper. - Ron Settles.

A letter is currently being prepared for submission to Physics Letters. This will be the 'α_S Paper', which will contain the various measurements of α_S using several methods and distributions.

The next paper will be the 'Fragmentation Paper'. This will include the standard distributions with tables and corrections etc., for all of the '89 data on the peak.

3a) Resume Of The Status Of The α_s Paper. - Glen Cowan.

This involved a recap of the data presented by Glen at the QCD Workshop (26th. April 1990).

The methods used to determine α_s are as follows.

By measuring a certain distribution i.e. Thrust, and the calculating the ratio Thrust(hadrons)/Thrust(partons), a fit can be made in the range where the ratio is ~1.0 $\pm$ 10%. This work was carried out using using LUND PS (HVFL). The values will be derived using HERWIG for comparison.

The method using Energy-Energy correlation still needs the errors to be both clarified and finalised.

The three best ratios for both LUND PS and LUND ME where the ratio is closest to 1.0 were found to be

a) Differential Jet Rate y_3 using the E0 algorithm - $\alpha_s = 0.127$.

b) m_h^2/s - $\alpha_s = 0.132$.

c) AEEC - $\alpha_s = 0.116$.

(0.105 by H. Hu).

It was agreed to show the ratios for all of the distributions in a certain range, and explain why the above three were determined to be the best. (i.e. they were the closest to 1.0). Then quote the value of α_s for these three only. The closer the ratio is to 1.0, then the closer the hadrons represent the parton dynamics.

Values so far have been calculated using charged particles only. However, work is proceding to include neutral particles also.

All data up to run #7767 will be used, but some formalism as to which data, how many Monte Carlo events etc. is required so better comparissons can be made between the analysis of different people.

Cross checks will be made on all the values calculated to date.

A status report on the α_S Paper will be presented at the next Tuesday meeting by Micheal Schmelling.

4) Next Meeting.

The next meeting will be on Thursday 07th. June. The Time and venue to be announced later. Also, until otherwise stated, meetings will be held on a once weekly basis.

5) Attached.

1 transparancy shown by Eberhard Lange.

4 transparancies shown by Ron Settles.

R' and α_s values from '89 and '90 data

R' values on the peak:

	R'	$\frac{1}{R'}$
'89 data	21.379 ± 0.995	0.0468 ± 0.0022
'90 data	20.253 ± 0.450	0.0494 ± 0.0011

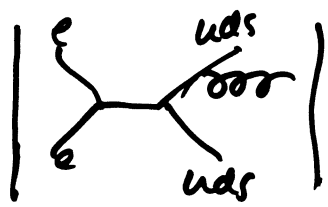
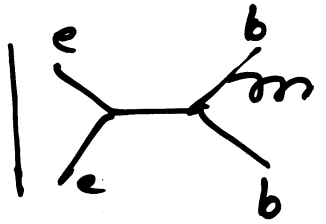
α_s:

	α_s	comment
'89 data	0.174 ± 0.072	(5 points, 90-92 GeV)
'90 data	0.076 ± 0.067	(peak only)
combined	0.121 ± 0.049	

$(\triangle\alpha_s)_{sys} = 0.04$
$(\triangle\alpha_s)_{theor} = 0.02$

$$\alpha_s = 0.12 \pm (0.05)_{stat} \pm (0.04)_{sys} \pm (0.02)_{theor}$$

FLAVOR DEPENDENCE OF α_s

Crazy Idea : $\left| \right.$  $\left. \right|^2 \overset{?}{\neq} \left| \right.$  $\left. \right|^2$

Tasso analysis : Z. Phys. C42 (1989) 17.

- Tag b events with vertex-weighting technique
- measure α_s using AEEC for b events
  " " " " " all events

$\Rightarrow$ measure $\dfrac{\alpha_s(b)}{\alpha_s(all)}$

$\rightarrow$ ratio less sensitive to fragm., cuts, etc

Some details :

- b-Tag : + make vertices with pairs of good tracks,
  + weight as fcn of orientation to prim. vert.
  + add up weights, cut to enrich b's :
  purity $68 \pm 7\%$; eff $16 \pm 1\text{-}2\%$
- 27k events $\rightarrow$ 448 b events
  fragmentation studies : $S, T, P_\perp^2, y,$
  $x_p, N_{ch}, \langle z_0 \rangle$

EEC: $f(\cos\chi) = \frac{1}{\sigma_0} \frac{d\Sigma(\cos\chi)}{d\cos\chi} = \frac{1}{N} \sum_{ij} \frac{E_i E_j}{W_{vis}^2} \delta(\cos\chi - \cos\chi_{ij})$

AEEC: $A(\cos\chi) = f(\cos\pi - \chi) - f(\cos\chi)$

$\dfrac{\alpha_s(b)}{\alpha_s(all)} = 1.17 \pm 0.50 \pm 0.28$

limited mainly by knowledge of b fragmentation ϵ_b : .003 .01 .03

Conclusion:

Unless understand fragmentation better, check only good to 20% level, even with high statistics

Another crazy idea:

- Measure α_s from $R' = \frac{\sigma_{had}}{\sigma_\mu}$ at peak

$$R' = \Gamma^0_{had}\left(1 + \frac{\alpha_s}{\pi} + \ldots\right)/\Gamma_\mu$$

$$\delta\alpha_s \simeq \pi \frac{\delta R'}{R'}$$

Barcelona $\frac{\delta R'}{R'} = .3\%_{stat} \oplus .7\%_{syst.}$ $100\,pb^{-1}$

ALEPH TO DATE: $2\%_{stat}$ $3\,pb^{-1}$

$\Rightarrow \frac{\delta\alpha_s}{\alpha_s} = 20\%$ (i.e. 0.12 ± 0.02)

" " " 40% stat 30% sys 20% th $3\,pb^{-1}$

- Do same thing for b's only

(forget )

$$R'_b = \Gamma^0_b\left(1 + \frac{\alpha_s(b)}{\pi} + \ldots\right)/\Gamma_\mu$$

$$\delta\alpha_s(b) = \pi \frac{\delta R'_b}{R'_b}$$

$\Rightarrow$ need to know N_b

Ataverelli Studies

$\frac{\delta N_b}{N_b} \gtrsim .08$ no matter how you try to tag b's

(OUR PAPER $\longrightarrow .11$)

main uncertainties: error in tagging eff., bckgd subtr.

$\Rightarrow \delta\alpha_s(b) = .25 \simeq 200\%$

$\Rightarrow$ need a BRIGHT IDEA

how to improve $\frac{\delta\sigma_b}{\sigma_b}$