

ALEPH 2000-046
CONF 2000-026
July 1, 2000

P R E L I M I N A R Y

Measurement of R_c at $\sqrt{S} = 189$ GeV/c² .

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Abstract

The ratio R_c of the $c\bar{c}$ to the $q\bar{q}$ production cross-sections is measured at a centre-of-mass energy of 189 GeV and is found to be $0.242 \pm 0.017 \pm 0.016$ for $\sqrt{s'/s} > 0.9$ and $|\cos\theta| < 0.95$. This results supersedes the preceding ALEPH results.

ALEPH contribution to the 2000 summer conferences

An improved measurement of R_c at 189 GeV/ c^2 is presented and supersedes the previous ALEPH result [1]. An integrated luminosity of 173.74 pb $^{-1}$ recorded at 189 GeV is used. $q\bar{q}$ events are preselected using the standard ALEPH exclusive hadronic selection [2]. An additional acceptance cut requiring that both jets have $|\cos\theta| < 0.9$ is applied to ensure that the event is well contained inside the micro-vertex detector.

Background from $b\bar{b}$ events is suppressed by taking advantage of the relatively long lifetime and high mass of B hadrons. The distribution of the event probability based on the impact parameters significance of charged tracks [3] is shown on figure 1(a). A cut requiring the estimator to be less than 2 suppresses 80% of $b\bar{b}$, while keeping of 86% of $c\bar{c}$ events. This $udsc$ selection cut is controlled on W pairs and their decay into $\nu qq'$ (figure 1(b)).

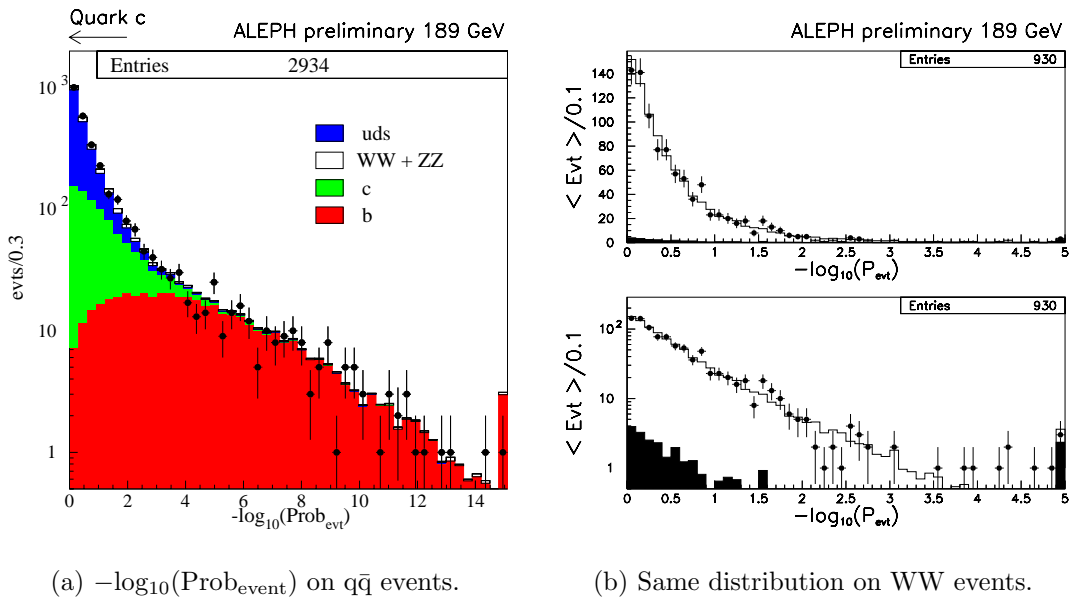


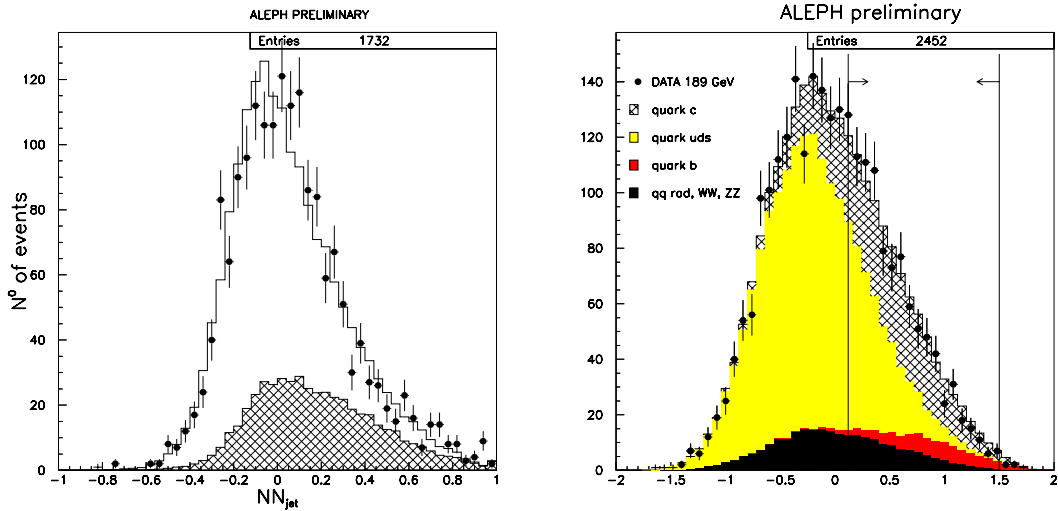
Figure 1: $b\bar{b}$ rejection.

The final selection of $c\bar{c}$ events uses a neural network algorithm trained to separate c jets from light quark jets. This network uses 9 input variables, exploiting the lifetime of D mesons, their masses and their decay into leptons or kaons. The 9 input variables are listed below:

- The confidence level that all charged tracks in the jet originate from the primary vertex.
- The confidence level that all charged tracks having rapidity with respect to the jet axis greater than 4.9 originate from the primary vertex.
- The decay length significance of a reconstructed vertex.

- The confidence level that the last track used to build a $2 \text{ GeV}/c^2$ mass system originates from the primary vertex, with tracks being ordered in decreasing consistency with the primary vertex.
- The sum of rapidities with respect to the jet axis of energy flow particles within 40 degrees around this axis.
- The energy of the four most energetic energy flow objects in the jet.
- The relative missing energy per jet.
- The largest rapidity lepton (electron or muon).
- The highest momentum kaon.

The distribution of the NN output per jet is controlled on a WW event sample for udc quarks and separately on an enriched b sample. The output of the NN for WW events is shown on figure 2(a). Data and MC are slightly shifted and the MC distribution is corrected by an amount of 0.0158 ± 0.0054 per jet leading to the dominant systematic error.



(a) Distribution of the NN output for WW. The contribution of $c\bar{c}$ events is hatched.

(b) Distribution of the NN output summed over the 2 jets.

Figure 2: $c\bar{c}$ selection.

The final distribution on $q\bar{q}$ events is shown on figure 2(b) together with the final selection cuts. In the data, 940 events are selected, of which 550.8 are estimated from the Monte Carlo simulation to be background events. The selection efficiency with respect to the hadronic preselection is $58.60 \pm 0.53\%$.

Finally, the value of R_c at $\sqrt{s} = 189$ GeV for $\sqrt{s'}/s > 0.9$ and $|\cos\theta| < 0.95$ is found to be:

$$R_c = 0.242 \pm 0.017(stat) \pm 0.016(syst)$$

The standard model expectation [4] is 0.252. This results supersedes the previous one presented in [1] Contributions of the statistical and systematical errors are summarised in table 1.

Statistical	± 0.0173
MC Stat	± 0.0049
Luminosity	± 0.0015
Hadronic Selection	± 0.0030
Radiative events	± 0.0025
$b\bar{b}$ rejection	± 0.0031
NN adjustment	± 0.0099
Fraction of $D^+, D^0, D^*, D_s, \Lambda$	± 0.0084
Branching ratio to lepton and kaon	± 0.0049
Lifetime	± 0.0004
Charged Multiplicity of D mesons decays	± 0.0002

Table 1: *Statistical and systematic errors on the measurement of R_c*

References

- [1] ALEPH Collaboration, *Contribution to the 1999 summer conferences*. ALEPH 99-018/CONF 99-013 EPS-HEP99 6-694.
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- [3] ALEPH Collaboration, *A Measurement of R_b using a life-time mass tag.*, Phys. Lett. B401(1997)150.
- [4] ZFITTER Version 6.23, Bardin et al., preprint DESY 99-070(1999),hep-ph/9908433.