Multiplicities of π^0, η, $\mathbf{K^0}$ and of charged particles in quark and gluon jets

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Abstract

We compared the multiplicities of π^0, η, K^0 and of charged particles in quark and gluon jets in 3-jet events, as measured by the OPAL experiment at LEP. The comparisons were performed for distributions unfolded to 100% pure quark and gluon jets, at an effective scale Q_{jet} which took into account topological dependences of the 3-jet environment. The ratio of particle multiplicity in gluon jets to that in quark jets as a function of Q_{jet} for π^0, η or K^0 was found to be independent of the particle species. This is consistent with the QCD prediction that the observed enhancement in the mean particle rate in gluon jets with respect to quark jets should be independent of particle species. In contrast to some theoretical predictions and previous observations, we observed no evidence for an enhancement of η meson production in gluon jets with respect to quark jets, beyond that observed for charged particles. We measured the ratio of the slope of the average charged particle multiplicity in gluon jets to that in quark jets, C, and we compared it to a next-to-next-to-next-to leading order calculation. Our result, $C = 2.27 \pm 0.20(\mathrm{stat} + \mathrm{syst})$, is about one standard deviation higher than the perturbative prediction.

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