Charged Multiplicities in Z Decays into u, d, and s Quarks

The OPAL Collaboration

Abstract

About 4.4 million hadronic decays of Z bosons, recorded by the OPAL detector at LEP at a centre-of-mass energy of around $\sqrt{s} = 91.2\,\mathrm{GeV}$, are used to determine the mean charged particle multiplicities for the three light quark flavours. Events from primary u, d, and s quarks are tagged by selecting characteristic particles which carry a large fraction of the beam energy. The charged particle multiplicities are measured in the hemispheres opposite to these particles. An unfolding procedure is applied to obtain these multiplicities for each primary light quark flavour. This yields

$$\langle n_{\mathrm{u}} \rangle = 17.77 \pm 0.51 \,{}^{+0.86}_{-1.20}\,, \ \langle n_{\mathrm{d}} \rangle = 21.44 \pm 0.63 \,{}^{+1.46}_{-1.17}\,, \ \langle n_{\mathrm{s}} \rangle = 20.02 \pm 0.13 \,{}^{+0.39}_{-0.37}\,,$$

where statistical and systematic errors are given. The results for $\langle n_{\mathrm{u}} \rangle$ and $\langle n_{\mathrm{d}} \rangle$ are almost fully statistically anti-correlated. Within the errors the result is consistent with the flavour independence of the strong interaction for the particle multiplicities in events from the light up, down, and strange quarks.

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