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Measurement of Two-Particle Correlations and Flow Coefficients in High Multiplicity e^+e^- Collisions using Archived ALEPH Data at 91-209 GeV

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We present measurements of two-particle angular correlations of charged particles emitted in high-energy e^+e^- collisions using data collected by the ALEPH detector at LEP between 1992 and 2000. The correlation functions are measured over a wide range of pseudorapidity and azimuthal angle as a function of charged particle multiplicity. Previous measurement with LEP1 data at $\sqrt{s} = 91$ GeV shows no significant long-range correlations in either lab coordinate or thrust coordinate analyses, with associated yield distributions in agreement with predictions from the PYTHIA v6.1 event generator. The use of higher collision energy LEP2 data allows access to not only higher event multiplicitybut also to additional production channels beyond the $e^+e^- \to \gamma^\star/Z \to q\bar{q}$ process. Notably, the highest multiplicity bin ($N_{\rm trk} \geq 50$) suggests a tantalizing disagreement with MC and implies the potential to search for collective phenomena in small systems. This measurement is pushing the studies of long-range correlation to the smallest collision system limit and includes the first flow coefficient (v_n) measurement in e^+e^- collisions, which uses a Fourier decomposition analysis to quantify the anisotropy in the azimuthal two-particle correlation as a function of charged particles' transverse momentum. This work supplements our understanding of small-system references to long-range correlations observed in proton-proton, proton-nucleus, and nucleus-nucleus collisions.

Category

Experiment

Collaboration (if applicable)

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