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Tantalizing Structure in Long Range Correlations in High Multiplicity e+e- Collisions and Fourier Decomposition 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 studies using LEP1 data at 91 GeV did not reveal significant long-range correlations in lab or thrust coordinates, and the associated yield distributions aligned with predictions from the archived PYTHIA v6.1 event generator. With the higher collision energy in LEP2, we gain access to increased event multiplicity and additional production channels beyond the Z->qq process. The highest multiplicity bin suggests an intriguing deviation from archived MC and implies the potential to search for collective phenomena in small systems. This measurement extends the exploration of long-range correlations to the smallest collision systems, introducing the first flow coefficient measurement and a Fourier decomposition analysis in e+e- collisions to quantify anisotropy in the azimuthal two-particle correlation relative to charged particles' transverse momentum. It is also compared with modern MC generators. This work supplements our understanding of small-system references to long-range correlations observed in proton-proton, proton-nucleus, and nucleus-nucleus collisions.

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