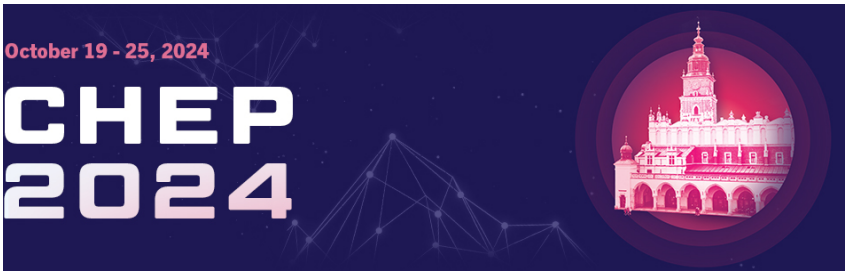

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Time-Of-Flight Correction for Hadrons at BESIII experiment

Monday 21 October 2024 15:48 (15 minutes)

Beijing Spectrometer (BESIII) detector is used for high-precision studies of hadron physics and tau-charm physics. Accurate and reliable particle identification (PID) is crucial to improve the signal-to-noise ratio, especially for K/π separation. The time-of-flight (TOF) system, which is based on plastic scintillators, is a powerful tool for particle identification at BESIII experiment. The measured time is obtained using an empirical formula, which is used for time walk and hit position corrections, with Bhabha events used as calibration samples. Time difference is defined as the difference between the measured time and the expected time. Systematic time deviations of charged hadrons have been observed in the time differences for different particle species. This kind of systematic time deviation, which depends on the momentum and particle species, has been reported in several experiments using TOF based on plastic scintillation counters. Similar behaviors have also been observed in simulations with different deviations. In this study, the dependence of time deviations on pulse heights and hit positions is systematically investigated using different species of hadron control samples. By applying corrections to the measured time, the time deviations are substantially reduced to nearly zero. The PID efficiencies of hadrons are enhanced both for real data and MC samples, and the systematic uncertainties of PID efficiencies are also optimized with further tuning. This study offers a new perspective on investigating time deviation in scintillation TOF detectors and provides a reference for improving detection accuracy.

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