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R&D of prototype iTOF-MRPC at CEE

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The Cooling Storage Ring (CSR) External-target Experiment (CEE) is a multipurpose nuclear physics experimental device to operate in the GeV energy range at the Heavy-Ion Research Facility (HIRFL-CSR) in Lanzhou, China. The primary goals of the CEE are to study the bulk properties of dense nuclear matter and to understand the quantum chromodynamic (QCD) phase diagram by measuring the charged particles produced in heavy-ion collisions at the target region with large acceptance. An inner time of flight (iTOF) system has been proposed to measure the multiplicity and time information of the charged particles. To meet the requirements of high granularity and high precision timing performance ($\sigma_t \sim 30$ ps), the multi-gap resistive plate chamber (MRPC) technology is used. In this report, we will report our approach to improving the time resolution of MRPC, including the optimization of MRPC structure, the consideration of signal integrity, and the improvement of readout electronics. The performance of iTOF-MRPC prototypes are presented according to the cosmic ray test. A timing resolution of better than 30 ps and an efficiency of better than 95% have been achieved.

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