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The CEE-eTOF wall constructed with new sealed MRPC

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The CSR (Cooler Storage Ring) External-target Experiment (CEE), located at the Heavy Ion Research Facility in Lanzhou (HIRFL), is designed for the physical purpose of approaching the critical point from the hadronic phase side in Quantum Chromo Dynamics (QCD) phase diagram. In addition, it is also expected to offer a probe for study on the density dependence of symmetry energy, and for hyper-nucleus measurement. Two identical TOF walls will be placed symmetrically at 6-meter downstream of the target as part of the dipole detector array, with zero degree vacated for collision centrality measurement. This work has given a preliminary technical design of the TOF wall, which consists of 6 modules, 24 MRPC detectors with 768 channels. The whole coverage of each wall is 2m × 2m. Reasonable width of overlap between MRPCs is considered to deal with the edge effect.

The Sealed MRPCs will be applied to form the TOF wall. With an elaborate integral sealing structure by 3D printing, the modularized assembling of this type can be achieved in the future mass production. More importantly, the gas consumption will be reduced significantly thanks to small gas volume. This improvement will help reduce the emission of gas with high Global Warming Potential (GWP) value, which is of concern at the background of "F-gas Regulation"by EU. The sealed MRPC prototype for CEE-TOF has been produced and tested. It has two stacks, each with 5 gas gaps of 0.25 mm thickness, divided by float glass plates, and has 16 readout strips with a 22 mm strip pitch (20 mm width and 2 mm gap), 52cm strip length. Differential signals are readout from both sides of the strip. Cosmic test result shows that the sealed MRPC prototype meets the performance requirement of CEE-TOF, reaching the plateau efficiency of over 96% and time resolution better than 70 ps, working stably with reasonable crosstalk and noise level. During about 1 month of the test time, the gas volume has excellent gas-tightness in a gas flow as low as 5 mL/min though 3 serial detectors, which verifies the module design for CEE-TOF operation. Thanks to the sealed design, cost and emission from gas consumption will decline, and the encapsulation and installation of TOF module can be simplified. The new sealed design of MRPC and test results will be presented in this paper.

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