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Study of a windowless RICH detector with C3F8 radiator

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Particle identification(PID) is crucial to particle physics experiments. The Ring Imaging Cherenkov(RICH) detector has been widely used for PID in a large momentum range, and long gaseous radiators are required to identify high-momentum particles. As to reduce the radiator length, a concept of windowless RICH was recently proposed and investigated.
In this work, a windowless RICH detector with an MPGD-based PD was designed. Its performance was simulated for different gaseous radiators including CF4, C2F6, C3F8, C4F10. Significant improvement on effective light yield by ~ 5 times was observed for all radiators. However, the fact that the PD has to use the same gas as the radiator poses a great challenge to the windowless RICH. A prototype of the windowless RICH was built to study the windowless concept with C3F8 radiator. The prototype was tested with cosmic rays. This report will describe the design of the windowless RICH prototype and present preliminary results on its performance.

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