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MRPC Detectors for Ultra High Rate Applications

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Content

The necessity for both higher precision and rates in high-energy physics (HEP) has advanced research and development concerning precise time and position measurements from a variety of detectors. Thanks to their excellent time accuracy, Multigap Resistive Plate Chambers (MRPCs) are often used as time-of-flight (TOF) detectors in HEP and nuclear experiments. In previous studies, a time resolution of 25 ps was obtained from a 20-gap MRPC with a 140 μm gap size and enhanced rate capability. In this work we consider a 10-gap MRPC with 160 μm gaps. This MRPC uses a new type of commercially available thin low-resistivity glass which further improves the rate capability. Tests were performed at the continuous electron beam at ELBE. This 10-gap MRPC reaches 97% efficiency at 19.2 kV with a time resolution of 36 ps at particle fluxes near 2 kHz/cm^2. At a flux of 100 kHz/cm^2, the efficiency is still above 95% and a time resolution of 50 ps is obtained. The broad hit rate capabilities of these MRPCs fulfill the requirements for their use in future experiments and for ultra high rate applications.

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