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Position measurement in RPCs using timing difference at both ends of strips

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This paper explores a technique in large area single gap Resistive Plate Chamber (RPC) where the position of the particle along a pickup strip is extracted by measuring the timing difference from the two ends of the strip. With precise time-measurement, the position can be measured more precisely than the conventional x-y strip readout with the same number of channels. The readout strips on either side of the RPC are kept aligned, i.e. in parallel, and the signals from both ends of the strip are read differentially to minimise noise. This technique has been successfully tested in the case of multigap-RPCs in [1] with resolution of 18 ps or 1.7 mm. It is expected that this method would work on single-gap RPCs also as the timing-difference resolution does not depend on the intrinsic fluctuations of timing of the device, as the signal will be induced to both the sides of a strip simultaneously. The intrinsic uncertainty due to fluctuation in avalanche formation will be common to both the ends and should also be cancelled out. A similar method has been tested on RPCs in [2] achieving a position resolution of 10.69 mm (timing difference resolution of 150 ps), but this was done using single ended signals with pickup strips mounted only on one side of the RPC which limits the performance. This paper will present the development of readout electronics and the results on the position measurement from timing differences with a single gap RPC using differential readout.

References

1. MRPC-PET: A new technique for high precision time and position measurements K.Doroud et al, Nuclear Instruments and Methods in Physics Research A (2011) https://doi.org/10.1016/j.nima.2011.09.008
2. Studies on fast triggering and high precision tracking with Resistive Plate Chambers G. Aielli et al, Nuclear Instruments and Methods in Physics Research A (2013) https://doi.org/10.1016/j.nima.2013.02.044

Session

Future Experiments and Detector Development

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