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A variable gain front end electronics for drift chamber readout

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The cluster counting/timing technique in a drift chamber is a consolidated technique to obtain a bias free impact parameter estimate. The application of this technique requires to identify the clusters of avalanching electrons from each primary ionization event. This is done by digitizing the signal from the sense wire in a drift chamber and applying an algorithm for peaks identification. The rise time of the signal from a cluster is approximately 1~ns, therefore a frontend electronics with about 1~GHz bandwidth is required. A high linearity and low distortion are also required to resolve the signal of each cluster.

A specific frontend electronics based on commercial components has been developed in order to detect signals from individual ionization clusters in a drift chamber. The readout channel is characterized by a high linearity, low distortion, and a bandwidth adequate to the expected spectral density of the signal. Furthermore, the readout electronics has been designed for an easily variable gain to get a signal which is always suitable for the digitizer, despite eventually changes in the working point of the drift chamber.

Signal amplification is obtained through two gain stages, made by a variable gain amplifier (VGA) and an output driver. Both devices have been chosen to be suitable for pulsed applications. Specific compensation techniques have been implemented to obtain an overall bandwidth of the order of 1~GHz. The serial interface is a generic 4-wire synchronous interface that is compatible with SPI-type interfaces used on many micro-controllers and DSP controllers. Since the used VGA is equipped with a chip select pin, it is possible to have different gains amplifiers in a multichannel frontend. Measurement of gain, bandwidth and linearity of the described device will be presented, furthermore, the response of the device to the signal obtained from a drift tube will be presented.

Collaboration

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