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Study of interstrip gap effects and efficiency for full energy detection of Double Sided Silicon Strip Detectors

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Abstract.
In this work is reported a study on the response of double sided silicon strip detectors. In order to investigate the effect of the electrode segmentation on the detector response, two experiments were performed aimed to measure the efficiency for full energy detection. Results show that the efficiency for full energy detection, that is directly related to effective width of the inter-strip region, varies with both detected ion energy and bias voltage. The experimental results are qualitatively reproduced by a simplified model based on the Shockley-Ramo-Gunn framework.

1. Introduction

Double Sided Silicon Strip Detectors (DSSSDs) are widely used in high energy and in nuclear physics studies. Their high granularity and their large area make them very suitable to perform, for example, accurate measurements of angular distributions and to study reactions where coincidences between more particles are requested. It is known that the segmentation of the electrodes affects the signal formation for particles whose trajectory crosses an interstrip region [1, 2, 3, 4, 5, 6]. In particular phenomena such as charge sharing and opposite polarity signals can occur. Such phenomena make the efficiency for full energy detection for DSSSDs lower than 100% as one can expect from a single pad detector. Therefore, for the analysis of data obtained by using DSSSDs, it is very important to select the events with the correct full energy and reject interstrip events.

We performed a systematic characterization of the dependence of DSSSDs inter-strip effects on the incident ion type, energy, and polarization voltage. Studies to identify an appropriate