The impact and persistence of electrostatic charge on the passivation of silicon strip sensors

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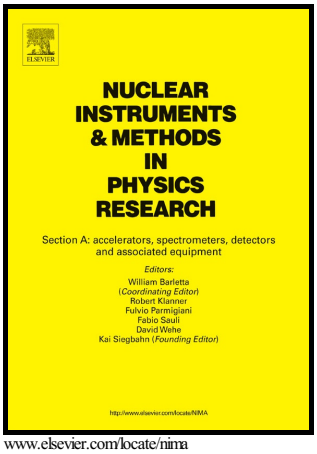

www.elsevier.com/locate/nima

PII: S0168-9002(16)30939-1
DOI: http://dx.doi.org/10.1016/j.nima.2016.09.016
Reference: NIMA59314

To appear in: *Nuclear Inst. and Methods in Physics Research, A*

Received date: 6 June 2016
Revised date: 18 August 2016
Accepted date: 7 September 2016

Cite this article as: A. König, T. Bergauer and P. Schmidt, The impact and persistence of electrostatic charge on the passivation of silicon strip sensors *Nuclear Inst. and Methods in Physics Research, A* http://dx.doi.org/10.1016/j.nima.2016.09.016

The impact and persistence of electrostatic charge on the passivation of silicon strip sensors

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Abstract

Silicon strip sensors as used for tracking detectors in high-energy physics experiments are bare large-area silicon devices without any packaging. To protect them from environmental influences like humidity and mechanical damage, a passivation is deposited as the uppermost layer. The passivation can consist of different materials like silicon oxide, silicon nitride, polyimides or doped glasses. In this study we first demonstrate the impact of static surface charge on the sensor characteristics. This is followed by investigations on how sensitive different passivation layers of silicon strip sensors are against charge-up and how these charge retains. For such purpose, a corona charge-up device has been built and used to charge up the detectors. The surface potential distribution caused by the charge was mapped using an electrostatic voltmeter. The self-discharge of sensors with different passivation layers was investigated by long-term studies.

Keywords: Silicon detector, Electrostatic, Charge-up, Surface potential mapping, Electrostatic Voltmeter

1. Introduction

Static charge located on top of the passivation layer of silicon strip sensors is able to influence the sensor characteristics. Depending on the polarity and the amount of charge, an inversion layer between the strips can be formed by the

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