Introduction

A moderate number of silicon strip sensors are used in the LHCb Inner Tracker. These sensors are designed to operate in a radiation environment of 0.1-1 Sv/year. The sensors have to withstand a maximum of 100000 hours of operation. In contrast to many silicon strip applications, a moderate capability to cope with high occupancy, high multiplicity and radiation tolerances is required. The silicon sensors are designed for the LHCb Inner Tracker. In the LHCb Inner Tracker, the sensors are used to provide coverage for the inner detector. The high particle rates severely constrain the technologies choice for tracking detectors.

Abstract

On behalf of the LHCb Inner Tracker.

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exhibited a very low break down voltage of about 110-130 V.

and correspondance to the different slips. The prototype sensor, however, a high current collection signal-to-noise performance of the radars. Moreover, a higher current collection efficiency (CE) over the full sensor has to be realized to ensure an efficient readout of the current carriers. The combined requirements of the 2.2 GHz (two sensors) long silicon ladders, the combined requirements of the signal to noise and long readout-strips with according high

In order to avoid pile-up of consecutive bunch crossings at LHC the stacking

4 First Prototypes

First studies on signal-to-noise, resolution and charge collection efficiency for the

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were ordered.

shifts per sector (three pairs), and for a slower (open squares) sampling time. The bars

w/p=0.2

track position

The efficiency of the T20Inm glass ladder for the different glass volatilities is shown in Figure 2

higher relationships were observed. Where charged collection seems to monotonically decrease, and faster from the ladder's peak. However, a significant change in the value for the T20Inm glass ladder. However, a significant change in the design

The observed spatial resolution was 70 μm which is better than the design

Because of their early function breakdown, laboratory conditions are kept close to the pre-experimental sessions.

Figure 1. Efficiency of the T20Inm glass ladder for the different glass volatilities is shown in Figure 2.
Trigger operation voltages above this value will not be necessary.

Because of the moderate radiation damage expected in the LHC Inner Tracker, the baseline voltage was not increased above 300 V. In Figure 3, the leakage current is shown as a function of the bias voltage. No

3.1 Sensor Test Results


tables are included. Table 1 summarizes the geometry parameters of the prototype sensors. Two different strip geometries, two different pitches of 197 µm and 277.2 µm, are

different strip geometries, two different pitches of 197 µm and 277.2 µm, are used in the study. A leakage detector, a thickness of 320 µm and consists of five regions which

New Ge and multi-geometry prototype sensors were manufactured according to

3. Full-size multi-geometry prototype sensors

Table 1

<table>
<thead>
<tr>
<th>Region</th>
<th>Pitch [µm]</th>
<th>Width [mm]</th>
<th>AC Width [mm]</th>
<th>Number of Steps</th>
<th>Active Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>197</td>
<td>57</td>
<td>35</td>
<td>6</td>
<td>108 mm x 72.6 mm</td>
</tr>
<tr>
<td>B</td>
<td>277.2</td>
<td>57</td>
<td>35</td>
<td>6</td>
<td>110 mm x 78.6 mm</td>
</tr>
</tbody>
</table>

and 100 A. Data was taken with slow shaping between two steps for the A region and different bias voltages of 0 A, 20 A, 40 A, 60 A, 80 A, and 100 A.

Figure 2: Efficiencies of the 20 cm Inner Tracker as a function of the track position in
leakage current \[ \text{nA} \]
The results of this test beam will provide the basis of the decision for the final

strip geometry for the LHCb Inner Tracker.

The results of the test beam data are shown:

\[ C_{tot} = 1.02 + 1.65 \text{ pf/cm} \]

3.3 Test beam results

When beam was descaled.

\[ \frac{d}{m} \]

where \( d \) is the distance between tracks, \( m \) the total number of

Different numbers refer to different sensors. The line in the graph

represents a total strip capacitance per unit length as function of the ratio strip width to

\[ C = \frac{1.02 \times 1 + 66 \text{ pf}}{d} \]
References

4 Conclusion and Outlook

Figure 2. Trigger delay of the short Hadron. The
delay is shown as function of the
S/N ratio of the Pb-lead at a beam
energy of 1.5 A GeV.