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Beam test results of a MAPS designed in a new 130nm High-Resistivity CMOS process

The Topmetal-M is a newly designed Monolithic Active Pixel Sensor (MAPS). It has a matrix of 512×100 pixels with the pitch of $40 \mu\text{m} \times 40 \mu\text{m}$. The Topmetal-M is implemented with a new 130 nm High-Resistivity ($> 1 \text{ k}\Omega\text{-cm}$) CMOS process. This process has four wells: the n-well, the p-well, the deep n-well, and the deep p-well. There are four different shapes of charge collection diode in this MAPS. A heavy-ion campaign and a laser test have been performed to study the performance of this sensor. The test results demonstrate it has a uniform response to particle energy deposition. After being exposed to 14.3krad, this sensor is still functional with a rather low rate of broken pixels. No single event was observed in both the two tests. The average spatial resolution is $\sim 9\mu\text{m}$. Therefore, this 130nm HR process is a good candidate for MAPS development. This paper will discuss the heavy-ion and laser beam test results of this MAPS.

Primary experiment

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