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Low Resistance Strip Sensors and Slim Edges Combined RD50 Experiment

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An update will be presented on the Common RD50 Project "Low Resistance Strip Sensors". Three RD50 institutes are collaborating in this project (CNM-Barcelona, IFIC-Valencia, and SCIPP-Santa Cruz), in which a new method to enhance the sensor hardness to beam-loss damage is studied. The fabrication has been combined with new experiments related with another RD50 Common Project involving Slim Edges. Additional wafers will be fabricated to try several experiments using deep reactive ion etching (DRIE) to cut the wafer closer to the sensor edge. A new mask has been designed for the definition of the trenches that will help the cleaving of the sensors for the cut.

Summary

In case of beam loss in large colliders, large amount of charge can be generated instantaneously in the sensors bulk which cannot be evacuated fast enough. In this scenario, the sensors can get damaged by the development of very large voltages across the coupling capacitor with the result of permanent damage in the strip. Usually, punch-through protection (PTP) structures are used to prevent this damage by activating a low resistive path for the large charge to be evacuated. Nevertheless, it has been shown that the strip resistance can inhibit the charge evacuation in the cases when the charge is generated far away from the PTP structure. In this project we try to reduce the strip resistance in order to make the PTP structures effective in all the cases.

We have designed, using our automatic layout generation tool, a set of 64-strips, ATLAS-barrel-like sensors with different PTP geometries and with a metal layer contacting all along the strip implant in order to reduce the strip resistance. Also, several test structures with DC pads along the strips have been designed which will allow a more precise measurement of the potential gradient in the strip in case of large charge generation. Some technological experiments have been also carried out in order to optimize the coupling capacitor fabrication, which will have to be made with Metal-Insulator-Metal (MIM) structures.

An additional mask has been designed to define trenches for Deep Reactive Ion Etching (DRIE) of some wafers. Three additional wafers will be fabricated in order to try different DRIE methods to form the trenches. The design has included trenches at different distances from the sensor edge, and several trench designs, in order to include a variety of experiment of the DRIE cutting and slim edges.

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