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The Silicon Electron Multiplier Sensor

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The Silicon Electron Multiplier (SiEM) sensor is a novel concept for minimum ionizing particle (MIP) detection, aiming for excellent time and spatial resolution with fine pitch and internal gain. Metal electrodes embedded in the silicon substrate, obtained with a MEMS technique, form the gain layer that can be controlled by applying a high electric field to the electrode contacts. Such a structure aims to overcome the typical gain deactivation mechanism due to irradiation that may affect performance in other sensor technologies such as LGAD and APDs, where the gain layer is realised via ion implantation. The SiEM is expected to withstand fluences of up to 10ˆ16 neq/cmˆ2, targeting applications for future colliders with a challenging radiation-hard environment. The simulations on the first structure show gain values higher than ten and a timing centroid of O(40ps). The production of the first strip demonstrators with the DRIE technique is ongoing. These new structure geometries are being implemented in TCAD to extend the study on their time and gain capabilities matching the production process. The first samples will be delivered and characterized with a laser setup and in test beams in the next few months.

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