DEVELOPMENT OF EQUIPMENT AND SETUP AIMED AT TESTING NOVEL AC-LGAD SILICON DETECTOR

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ABSTRACT

Low-gain avalanche diodes (LGADs) are a class of silicon sensors developed for the rapid detection of minimum ionizing particles. LGAD represents a major technological innovation in the field of particle detection, offering increased performance and new possibilities for experiments in high energy physics as well as other application areas. In fact, nearly two million LGAD sensors will be assembled to build one of the very first high-granularity time detectors, which will be essential for the next phase of the LHC, where collisions will be so numerous that it will be impossible to distinguish them. between them, using only spatial information. They feature of AC-LGAD sensors is the way they transfer signal in an analog manner through a capacitively coupled connection to external electronic circuits. This type of coupling enables the extraction of the output signal. AC-LGAD are known for their sensitivity to rapid signal variations and are often used in applications requiring. The DC-LGAD sensor is designed to be directly connected to external electronic circuits without the use of capacitor. This direct connection allows the detection signal to be extracted directly from the sensor, thus providing an extended frequency response and improved linearity in the signal's response. AC-LGADs are typically used in environments requiring high precision and fast, linear response, such as high energy physics experiments and detection application where precise spatial resolution is crucial. Our work initially consists of carrying out the electrical characterization of AC-LGAD sensors and the electrical characterization of silicon diodes. Then make a comparison of the results obtained in order to study the performance of AC-LGAD. We are commissioning a cold probe station in which we can perform electrical characterization, primarily IV scans on LGAD sensors at low temperatures. Initially we have been working on the thermal insulation of the probe station and identifying the optimum functionalities of instruments like the Chiller, Peltier which we use to cool down on the chuck on which sensors will be placed. We also worked on the Nitrogen supply to the station which is used to prevent condensation in the station when the temperature drops below 0C. This probe station will enable us to handle many sensors at a time to take IV below -30 C. This station will also help take IVs of irradiated sensors at low temperatures and prevent reverse annealing.