

New developments in Ultra Fast Silicon Detectors at FBK

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Over the last few years, Fondazione Bruno Kessler, in collaboration with the universities of Trento and Turin, has been involved in developing of Silicon sensors with low internal gain, the so-called Ultra-FAST Silicon Detectors (UFSD). Such a detector is based on the concept of Low-Gain Avalanche Detectors (LGAD), which are silicon detectors with an internal, low multiplication mechanism (gain ~ 10).

The first production batch (completed in 2016) was fabricated on 275 μm thick Silicon substrates. It was aimed at testing both the functionality and the reliability of the new proposed fabrication technology, showing excellent results in terms of gain and timing resolution.

In this contribution, we report on the last developments carried out at FBK on UFSD technology in the last year. A second pilot batch (completed in late spring 2017) has been produced on Silicon-to-Silicon wafers with a thickness of 50 μm , in order to improve the timing performance. In this production, we tested also new techniques to improve the radiation hardness of the devices. Two different dopant elements (Boron and Gallium) have been used to realize the multiplication junction, as well as carbon co-implant has been tested on some wafers.

We report on the preliminary electrical characterization of these devices, discussing the effect of doping and carbon co-implant on the detector noise and gain.

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