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First characterisation of Trench Isolated LGADs fabricated at Micron Semiconductor Ltd

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We are excited to present the first results from our Trench Isolated Low Gain Avalanche Detectors (TI-LGAD), developed in collaboration with Micron Semiconductor Ltd and the Scottish Microelectronics Centre. The TI-LGAD represents an innovative approach to low gain avalanche diodes (LGAD), featuring fine segmentation and narrow trenches (1 μm) that effectively isolate adjacent pixels. This design significantly narrows the no-gain inter-pad region to under 2 μm, a notable improvement from the 20-80 μm range seen in conventional LGAD technology. Such enhancement enables sensors with a finer pixel pitch and greater fill-factor, crucial for advancements in particle physics and imaging applications.

Prototypes of this cutting-edge technology, produced by Micron Semiconductor on 250 μm thick wafers, have undergone characterization using the transient current technique (TCT). The results demonstrate that trench-isolation effectively isolates the pixels, ensuring a low dark current and maintaining the sensor's gain, all while achieving a near 100% fill factor. Additionally, IV measurements indicate no premature breakdown at the trenches, with breakdown voltages reaching up to 1000V.

These findings align closely with our process simulation studies, which were instrumental in optimizing the trench width and depth to maximize the fill factor.

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