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Development and Characterization of CMOS Sensor for High Energy Hadrons for radiation therapy applications

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The current prototype for the proposed sensor was developed in 180nm TSI HV-technology with a 24x40 pixel matrix. Single pixels exploit deep nwells on p-substrate diodes. Secondary particles are collected on the deep n-wells which include the front-end pixel electronics. Front-end electronics contains an integrator in addition to a comparator. Each time the charge acquired surpasses the threshold of the comparator a pump pulse is generated and counted into an 8-bit register, and the integrator is reset. By storing an 8-bit timestamp of the first and last pump, it is possible to obtain with presition the charge acquired during the integration time. A 16-bit output resolution is achieved by this Pump-timestamp method, which is converted into 2 LWDS lines with 4 bits in parallel, to increase data transfer speed, as well as to maintain the integrity of the output. Preliminary tests shown a noise floor of 0.8 fC with a maximum charge of 3000 fC, limited by the resolution bits. The sensor presents a linear response along the whole dynamic range. A test with a high energy particles beam was carried out, the results show the performance of the sensor under real life conditions, as well as the radiation hardness capabilities of it.

Collaboration

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