

Monolithic pixel detectors

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Monolithic detectors integrate sensor and readout in one piece of silicon and therefore present advantages compared with hybrid detectors in terms of detector assembly, production cost and detector capacitance. Despite years of intensive research they have not yet been widely adopted for high energy physics. Several functional devices on high resistivity silicon have been developed but often require fabrication steps incompatible with high volume manufacturing in standard semiconductor foundries. Recently devices have been manufactured in more standard CMOS technologies, with several improvements, but preserving the low capacitance and efficiency over the full surface for more complex readout circuitry has remained a challenge. An overview will be presented of different approaches to realize monolithic detectors, including developments using monolithic active pixel sensors (MAPS), deep well implants, silicon on insulator (SOI) and high resistivity substrates. Their performance in terms of particle detection and radiation tolerance will be discussed as well as power consumption which is a key parameter. An effort will be made to point out the challenges that need to be overcome for monolithic detectors to be adopted more widely in high energy physics.

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