

Status and perspectives of the development of pixel sensors based on 3D vertical integration

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The development of 3D vertical integration in the microelectronic industry brings along significant advantages for pixelated semiconductor radiation sensors in cutting-edge scientific experiments at high luminosity particle accelerators and advanced X-ray sources. These applications set very demanding requirements on the performance of sensors and their readout electronics, in terms of pixel pitch, radiation tolerance, signal-to-noise ratio and capability of handling very high data rates. 3D vertical integration of two or more layers with sensors and CMOS devices naturally leads the designer towards extending pixel-level processing functionalities and achieving novel structures where each layer is optimized for a specific function. For front-end electronics, 3D integration could be a way to avoid using CMOS technologies with a feature size of a few tens of nm, nevertheless achieving a very high functional density for the integration of complex analog and digital circuits inside a small pixel cell. This talk reviews current efforts in the high energy physics community towards the development of novel vertically integrated pixel sensors and discusses the challenges that are being tackled to qualify these devices for actual applications.

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