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First batch of thin 3D silicon sensors at USTC

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Unlike the planar sensors, the distance of electrodes and the thickness of substrate is decoupled in 3D silicon detector. According to the shapes of electrodes, 3D sensors can be divided into two types: the columnar electrodes and the trenched electrodes. Through shortening the distance between the electrodes, the sensor can provide higher position resolution and can also be more irradiation tolerant due to the decreased trapping probability of carriers. However, the electrode itself can form the inactive area when the particle vertically passes through the top of the sensor. Nowadays, the electrodes with 5 μm or less in diameter have been fabricated. Typically, in order to withstand the fluence of 1×10^{16} n_{eq}/cm^2, the ATLAS Inner Tracker (ITk) will use 3D pixel sensors with 5 μm diameter columnar electrodes and small pixel cells (50×50 μm^2 and 25×100 μm^2) which are fabricated by the FBK (Itlay), CNM (Spain) and SINTEF (Norway). Also, the timing resolution of 3D sensors has been investigated which shows great potential to realize the 4D tracking. Recently, the USTC group is concentrated on the development of 3D pixel sensors and this talk will present the fabrication and characterization of first batch of the USTC 3D sensors.

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