

DEPFET pixels as a vertex detector for the Belle II experiment

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The successful heavy flavor factory KEKB, operating between 1999 and 2010 at KEK, Tsukuba, Japan, is currently being upgraded to SuperKEKB, which is foreseen to start commissioning in the fall of 2014. SuperKEKB will provide an instantaneous luminosity of $8 \times 10^{35} \text{ cm}^{-2}/\text{s}$, 40 times higher than the current world record set by KEKB. For SuperKEKB, a nano-beam scheme is applied to achieve this ultra-high luminosity.

In order to handle the increased event rate and the higher background and to provide high data quality, the Belle detector is upgraded to Belle II. In particular, a new vertex pixel detector with high granularity, surrounding the beampipe of only 20 mm diameter, will be installed, followed by 4 layers of double-sided Si strip detectors. The pixel detector is based on the DEPFET technology and consists of two layers of active pixel sensors. By integrating a field effect transistor into every pixel on top of a fully depleted bulk, the DEPFET technology combines detection as well as in-pixel amplification. This technology allows excellent signal to noise performance, complemented by a very low material budget, which is achieved by thinning down the sensors to 75 microns. The sensors will be operated by a dedicated chain of steering and readout ASICs.

In this presentation the key parameters of the sensor design will be presented, together with the individual ASICs. Furthermore, supplementary systems like cooling, powering, mechanics, etc. will be described. Results of the prototypes tested in various particle beams will be shown as well as the expected performance at SuperKEKB.

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