The DEPFET

Detectors for experiments at future colliders - e.g. the Super B-factories or the ILC - require excellent vertexing performance for the layers close to primary interaction region. For precise vertex reconstruction, highly granular pixel detectors are needed, together with fast readout and minimum material budget to reduce the impact on the measurement due to multiple Coulomb scattering. The latter requirement severely constrains the sensor thickness, power consumption, and the design of the detector services.

The DEPFET technology of active pixel sensors is among the frontier detector concepts for high energy physics at high luminosities. It has been chosen for the new Belle II experiment at the SuperKEKB collider in Japan. The in-pixel amplification of the DEPFET technology allows for very thin low-noise sensors. The front end electronics and the data acquisition concepts supporting the integration into Belle II are finalized and the two-layer detector (PXD) will be ready for acquiring data from 7.6 million pixels in 2015.

The vertex detector of Belle II (PXD) uses DEPFET monolithic silicon active pixel sensors which do not require additional support or cooling structures in the active region of the detector. Spatial point resolutions (leave out the 50 degrees) below 10 µm are expected.

Conclusions

The exciting physics experiment Belle II is under preparation at KEK. The goal to start data acquisition in 2015 seems realistic and the pixel detector will be ready with all required properties. Beam tests and simulations are important in validating the detailed simulations, and convey a deep understanding of the properties of the real modules. The predicted resolution of the DEPFET modules from simulations is now confirmed by a beam test analysis. The required precision of the Belle II PXD sensors seems to be realistic and feasible.