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The DEPFET based all-silicon module for the Belle II Pixel Detector PXD: construction, assembly and installation

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Belle II located at the SuperKEKB collider at KEK, Japan, started data taking in March 2019 and is currently in the 1st long shutdown (LS1) after reaching the peak luminosity of 4.7e34 /cm2.s and collected about 430 fb-1 of data. Crucial to the Belle II detector is the Pixel Sub-Detector (PXD), which provides precise vertexing capabilities in a challenging radiation environment. LS1 opens the opportunity to replace the 1st de-scoped version of PXD (PXD1) with the fully completed arrangement of DEPFET modules forming PXD2.

This presentation focuses on the concept and assembly of the unique DEPFET based all-silicon modules for PXD1 and PXD2, discussing the performance of PXD1 and transition from PXD1 to PXD2. PXD2 passed the commissioning phase and is at the time of writing being installed in the interaction region of Belle II.

We will describe in detail our experience during the construction and assembly of the modules. The presented technology allows the currently most light-weight pixel detector in operation. The material is just about 0.2% of a radiation length including all structures needed for interconnection, support, and thermal management. This is only possible with the unique approach where all read-out ASICs and interconnects are integrated on a micro-machined and self-supporting piece of silicon with the ultra-thin active DEPFET pixel sensor as integral part of the module.

We will conclude with the application of this module concept for other experiments like direct electron detectors and the outlook to integration of micro-channels into the supporting silicon.

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