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DEPFET Based Ultra-light All-silicon Modules for Vertexing at a Future Linear Collider

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The DEPFET Collaboration develops highly granular, ultra-thin active pixel detectors for high-performance vertex reconstruction at future collider experiments. A fully engineered vertex detector design, including all the necessary supports and services and a novel ladder design with excellent thermo-mechanical properties, is being developed for the Belle II experiment. The self-supporting all-silicon ladder combined with the low power density of the DEPFET array and a cooling strategy that relies on forced convection of cold air to cool the active area allow for a very thin detector. I this paper, the technical implementation of the all-silicon concept of Belle II is extended to the extremely material senstive forward region of a vertex detector at the ILC. In addition, a novel cooling concept based on fully integrated micro-mechanical cooling channels in the support silicon will be discussed on the basis of simulations and measurements on realistic thermally active all-silicon samples.

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