Letter to DRD3 from Belle II R&D community on silicon detectors

Dear DRD3 steering committee, 2023, February 24th

The signatories of this letter represent groups involved in the development of an upgrade version of the Belle II vertex detector. This new detector is based on 5 layers equipped with a monolithic active pixel sensor, currently under design in the TowerSemiconductor 180 nm process.The installation targets a SuperKEKB collider shutdown being planned around 2027. We understand that such a mid-term goal driven by a specific experiment is not part of the ECFA detector R&D roadmap. However we underline that Belle II also considers long term upgrade plans, beyond 2030.

Two experiment improvements require R&D on semi-conductor detectors. New MAPS featuring large area close to wafer size, allowing ultra-light detection layers will be required for vertexing and tracking. Such new sensors should simultaneously offer timestamping ability in the nanosecond range. Another key new detector layer is expected to provide a time resolution useful to identify particles with the time of flight technique, hence around 50 ps.

The requirements listed above match those listed in the ECFA roadmap for solid-state detectors. As such they are listed among the research interests indicated by the various groups signing this letter in their respective response to the DRD3 questionnaire.
Knowing that very long term R&D necessitates intermediate goals to maintain momentum, we underline that prototypes oriented toward the Belle II requirements (and most probably other experiments as well) could play the role of such milestones.
We also stress that the connection with a large laboratory like KEK offers valuable opportunities for detector R&D. Among them, the recently achieved few GeV electron beam line devoted for testing detectors (very similar to the DESY beam test facility).

In conclusion, the signatories below make up a well structured community performing state-of-the-art instrumental developments, which will acquire a strong expertise on the development of MAPS in the mid-term and which targets some of the key ECFA R&D themes for solid-state detectors in the long term. Consequently, we invite the DRD3 steering committee to consider fully the European Belle II community as well as its KEK partner when structuring the activities within DRD3.

Best regards,

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