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The Belle II detector

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While B factories were built to check whether the Standard Model with the CKM matrix offers a correct description of CP violation,
the next generation of B factories (so called super B factories) will look for departures from the Standard Model. For such a study, a 50 times larger data sample is needed, corresponding to an integrated luminosity of 50 abˆ-1. To achieve the necessary increase of event rates by a factor of 40, a substantial upgrade is required both of the accelerator complex as well as of the detector.

To maintain the excellent performance of the detector, the critical issue will be to mitigate the effects of higher backgrounds (by a factor of 10 to 20), leading to an increase in occupancy and radiation damage, as well as fake hits and pile-up noise in the electromagnetic calorimeter. Higher event rates require substantial modifications in the trigger scheme, DAQ and computing relative to the current experiments. In addition, improved vertex detection and hadron identification are needed, and similarly good (or better) hermeticity is required.

For the Belle-II detector, the following solutions will be adopted.
The new vertex detector will have two pixel layers, at r = 14 mm and r = 22 m around a 10 mm radius Be beam pipe, and four double-sided strip sensors at radii of 38 mm, 80 mm, 115 mm, and 140 mm. The pixel detector will be based on DEPFET sensors. A significant improvement in vertex resolution is expected with respect to Belle, both for low momentum particles because of reduced Coulomb scattering, as well as for high momentum particles
because the high resolution pixel detector is closer to the interaction point. Another important feature is a significant improvement in K_S reconstruction efficiency with good vertex resolution because of a larger volume covered by the vertex detector. An improved charged hadron identification performance will be achieved by using two novel devices, a time-of-propagation (TOP) counter in the barrel part, and a RICH with a focusing aerogel radiator in the forward region of the spectrometer. The electromagnetic calorimeter in the barrel part will use the existing CsI(Tl) crystals, but will employ a wave-form sampling read-out system; in the end-caps CsI(Tl) will be replaced by pure CsI. The resistive plate chambers of the end-cap muon and K_L detection system will be replaced by scintillator strips, read out by SiPMs. All components will be read out by a wide-band readout electronics and with an improved computing system.

The proposed talk will focus on the most important features of the new detector system.

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