

Polarization Upgrade and Polarimetry at the SuperKEKB Facility

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SuperKEKB is an unpolarized electron-positron collider designed for a luminosity of $8 \times 10^{35} \text{ cm}^{-2} \text{ s}^{-1}$ with a 4 GeV positron beam (Low Energy Ring - LER) and 7 GeV electron beam (High Energy Ring - HER). To enable precision measurements of the weak neutral couplings in the Belle II experiment, an upgrade is under consideration to polarize the HER to 70% by injecting polarized electrons (due to the short beam lifetime, Sokolov-Ternov self-polarization is impractical). In most areas of the HER the spin will be oriented transversely, but around the interaction region spin rotators will align the spin longitudinally. In addition to Mott polarimetry in the injector, we will measure the stored beam polarization to a precision of 0.5% with a combination of Compton polarimetry and measurements of the forward-backward asymmetries in $e^+e^- \rightarrow \tau^+\tau^-$ events at the interaction point. This will allow measurements of $\sin^2\theta_W^{\text{eff}}$ with a combined uncertainty comparable to the Z^0 world average measured uncertainty of ± 0.00016 from LEP and SLD, but made at a significantly lower energy scale of 10.58 GeV.

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