

SNOWMASS LOI:

e- Polarization SuperKEKB text

change last paragraph in draft from:

3) requires additional hardware investment in SuperKEKB for handling of spin but will allow access to new observables in tau lepton physics and world-leading measurements of electroweak asymmetries.

To:

3) requires additional modest hardware investments in SuperKEKB to introduce e- beam polarization, which opens unexplored discovery windows through a new program of electroweak measurements of unprecedented precision involving beauty, charm, taus, muons and electrons.

Add Two paragraphs:

With polarized electrons in SuperKEKB, Belle II will be able to measure the neutral current vector coupling constant - and hence the weak mixing angle, $\sin^2\theta_W$ - for b-quarks, c-quarks, tau, muon and electrons at substantially higher precisions than those made at the Z-pole at LEP and SLC. Such measurements at 10.58GeV are sensitive to parity-violating dark-sector Z_D bosons and open unique windows for discovering new physics unavailable at any other facility. A polarized electron beam would also substantially increase the precision of tau g-2 and tau EDM measurements.

The aim is for ~70% polarization with an 80% polarized source (SLC had 75% polarization at the experiment) where vertically polarized electrons are injected into the High Energy Ring. The spin is then rotated with solenoidal and dipole fields to longitudinal before the interaction point(IP), and then back to vertical after IP using solenoidal and dipole fields. A Compton polarimeter will monitor longitudinal polarization with better than 1% absolute precision and provide real time polarimetry. The absolute polarization will be measured in Belle II at the per mil level with the measurement of the forward-backward tau polarization asymmetry. The goal would be to install the hardware, at a cost of roughly \$25M, during the long-shutdown planned for around 2026.
