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Development of beam-collision feedback systems for future lepton colliders

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Future lepton colliders such as the International Linear Collider (ILC), and the Compact Linear Collider (CLIC) require nanometer-sized beams at the interaction point (IP). We report on the design, prototyping and testing of beam-based feedback systems for steering the beams into collision at the IP so as to maximise the luminosity performance of the colliders. Both all-analogue and digital feedback prototypes have been built and tested for CLIC and ILC, respectively. The latency of such systems needs to be very low so as to match the bunch spacing and bunch-train length. We report on the achievement of systems with 130ns and 23ns latency that meet the beam

position resolution and beam kick requirements of both ILC and CLIC, respectively; the prototypes were tested with ILC- and CLIC-like beams at the Accelerator Test Facility at KEK. We have simulated the measured performance and demonstrated the potential of the feedbacks to compensate for ground-motion disruption and recover

almost all of the design luminosity.

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