Upgrade of KEK Electron/positron Linac Control System for the both SuperKEKB and Light Sources


High Energy Accelerator Research Organization (KEK)

THMPL02
Multi-purpose injector linac

- 7-GeV electron 4-GeV positron injector linac at KEK has supported the both particle physics and photon science storage rings for more than 30 years.

- Natures of beam demanding approaches from those experiments are so different that the operation becomes tough to be planned, especially for construction and maintenance.
  - long-term integrated performance vs. short-term beam stability
  - continuous improvements vs. preventive planned maintenance
  - The control system should help enabling the consistent operation.
Pulse-to-pulse modulation (PPM)

- Dual-layer controls based on MRF event controls and EPICS controls were employed in the last stage of previous KEKB project.
- Further improved for SuperKEKB with MRF/SINAP 3 x EVGs and ~100 x EVRs.
- Many PPM-capable pulsed devices were added.
  - 66 pulsed quad, bend, and corrector magnets with newly designed power supplies
  - LLRF drivers and monitors with IQ controls on FPGA and embedded EVRs
  - High-precision BPMs with wide-dynamic range, and beam wire-scanners indispensable for beam emittance management
  - Damping ring and main ring injection/extraction devices
- Picosecond-level synchronization and dynamic operational configuration should be available
Multiple virtual accelerators

- Several beam modes are prepared
  - 2.5, 4, 6.5 & 7 GeV, 0.2 ~ 10 nC / bunch, e- & e+
- Each set of beam-mode event parameters make the single injector behave as independent virtual accelerators.
- The system is under tuning with new equipment.
- This virtual accelerator concept should satisfy the both particle physics and photon science users with the simultaneous top-up injections.