The BPM DAQ System Upgrade for SuperKEKB Injector Linac
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Issues for SuperKEKB Injector Linac

• Simultaneous injection for 4 independent rings (SKB e-/e+, PF, and PF-AR) w/ different beam energies.
• Increase positron beam intensity:
  • $1 \Rightarrow 4 \text{nC/bunch}$
• Increase electron beam intensity and Reduce electron beam emittance w/o Damping ring:
  • $1 \text{nC} \Rightarrow 5 \text{nC}$
  • $100 \text{mm-mrad} \Rightarrow 20 \text{mm-mrad}$
• High precision beam position measurement and control ($< 10 \mu\text{m}$)

Low Emittance transport w/o damping ring

• Misalignment of accelerating structure and quadrupole magnet cause the emittance growth.
• Assuming KEK injector linac configuration (#C~#5 sector), $5 \text{nC}$ charge and initial emittance of $10 \text{mm-mrad}$, the acc. structure misalignment of 0.5 with standard deviation cause the emittance growth ($168 \text{mm-mrad}$ at maximum) as shown in FIG. 2.
• However, the fine control of beam offset and angle can cure the emittance deterioration as shown FIG. 3.

Current BPM DAQ System

• Simultaneous measurement of 2 bunch beam with 96 ns interval
• Fast data acquisition up to 50 Hz
• Woks as an EPICS IOC

Candidate for New DAQ System

• LIBERA Brilliance Single pass (i-tech)
• Widely used for recent accelerator facilities.
• 120 MSa/s ADC with 16-bits of resolution, SAW filter
• Attenuator control range: 0 dB ~ 31 dB
• Implementation of the fast attenuator control function is going on for our specific needs.

Requirement for New BPM DAQ System

• Woks as an EPICS IOC
• Fast data acquisition up to 50 Hz
• Simultaneous measurement of 2 bunch beam with 96 ns interval
• Acquisition for wide range of charge intensity: $0.1 \text{nC} \sim 10 \text{nC}$

Summary and future plan

• Toward SuperKEKB injector upgrade, a new BPM DAQ system is under evaluation (LIBERA).
• We are aiming at achieving the measurement precision less than 10 $\mu\text{m}$.
• Result of beam test shows that the measurement precision could be less than about 15 $\mu\text{m}$.
• Other DAQ schemes are now under consideration.

• In the near future, beam test by 3BPM scheme will be carried out for accurate evaluation.
• Functionality of fast attenuator control will be also tested.