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Upgrade of KEK electron/positron Injector Linac by using pulse magnets and machine learning

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The KEK injector linac injects high-charge electron and positron beams into the high-energy-ring and low-energy-ring of SuperKEKB respectively. The linac also injects electron beams to the two light source rings, PF ring and PF-AR. We operate simultaneous top-up injections into the four rings by using many pulsed magnets. We have been upgrading the linac to attain the higher-quality beam injections for the SuperKEKB rings. In the summer of 2023, large-aperture quadrupole pulsed magnets have been newly installed upstream of the linac and driven by large-current pulse power supplies at markedly high electric efficiency. These new magnets bring the pulse-by-pulse optics changing to provide the high-quality beams. In order to cope with the complex beam injections to the four rings, we have introduced the automatic adjustment system by using machine-learning. The system surpasses human skill in beam adjustment and has resulted in significant increases in the amount of beam charge and beam transmission.

We will report on the results of these upgrades.

Footnotes

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