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Ultra-fast Longitudinal Bunch Diagnostic at the KARA Booster Synchrotron

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At the KARA accelerator, after the electron bunches are pre-accelerated by a 3 GHz microtron, a booster synchrotron operating at 500 MHz is used to increase the energy of the electrons from 50 MeV to 500 MeV, before they are injected into the storage ring. Due to various effects, the injection efficiency from the ring is rather low. To investigate these inefficiencies and remedy them, fast beam diagnostics are needed.

Currently the sum signal from a beam position monitor and an oscilloscope are used to measure an average longitudinal beam profile over many turns, which is insufficient to observe e.g. the injection period.

Therefore, we propose to replace the oscilloscope with a high-speed digitizer with the appropriate trigger capabilities and to deploy a photodiode at the synchrotron light port of the booster synchrotron.

Doing so enables turn-by-turn and bunch-by-bunch diagnostic needed to investigate events that differ over a few turns, as well as instabilities in-between the electron bunches.

Summary

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