Status and Performance of LumiBelle2 in the 2024 Beam Operation of SuperKEKB

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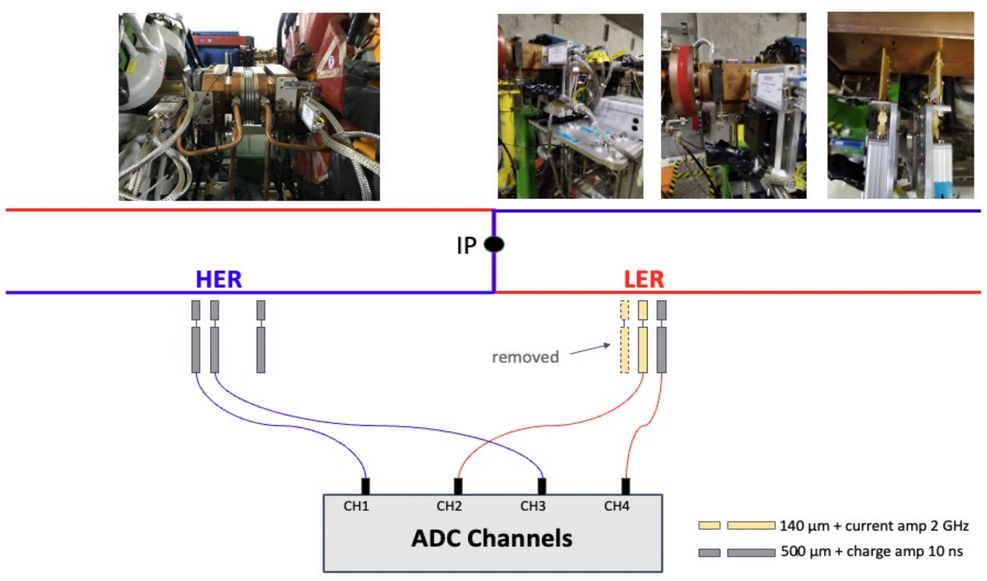
Introduction

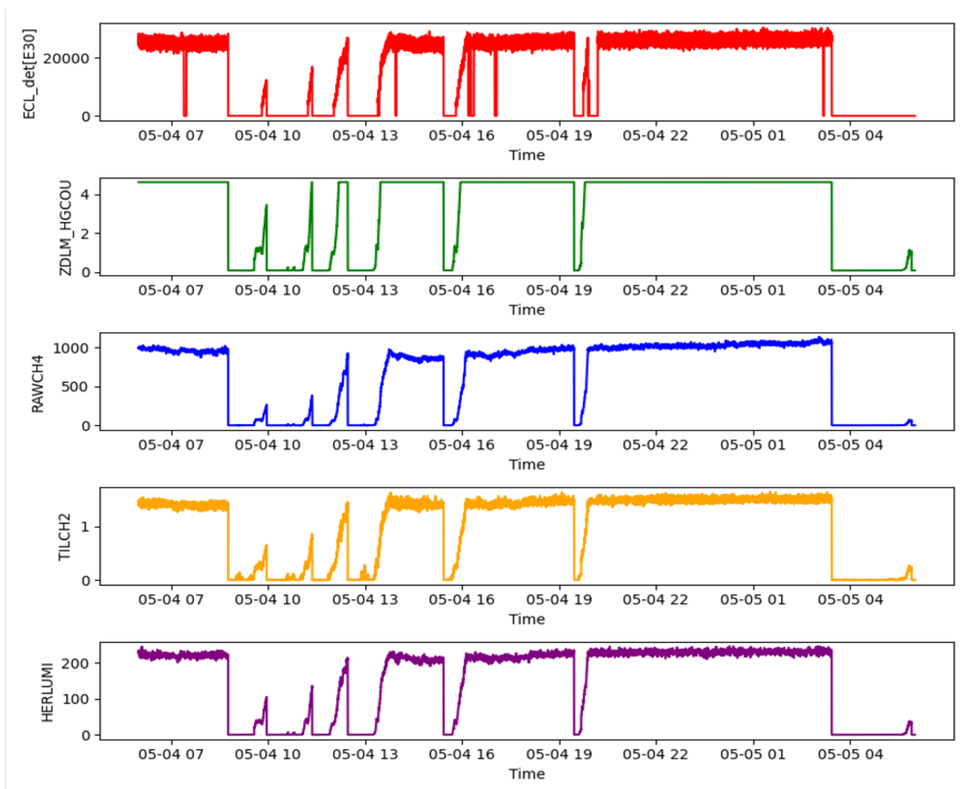
LumiBelle2 is a fast luminosity monitoring system designed to do fast luminosity feedback and machine tuning for SuperKEKB. It uses sCVD diamond detectors placed in both the electron and positron rings to measure the Bhabha scattering process at vanishing photon scattering angle. The system provides Train-Integrated-Luminosity signals at 1 kHz for dithering feedback and Bunch-Integrated-Luminosity signals at 1 Hz to monitor variations along the bunch trains. From July 2022 to the end of 2023, SuperKEKB had a long shutdown for maintenance and upgrades. In order to ensure LumiBelle2 satisfactory operation during the 2024ab run, a program of checks and calibrations of the LumiBelle2 hardware and software components was implemented before the restart of the accelerator complex. In this paper, the updated status of LumiBelle2 is reported followed by a report on obtained luminosity monitoring performance, based on the new data.

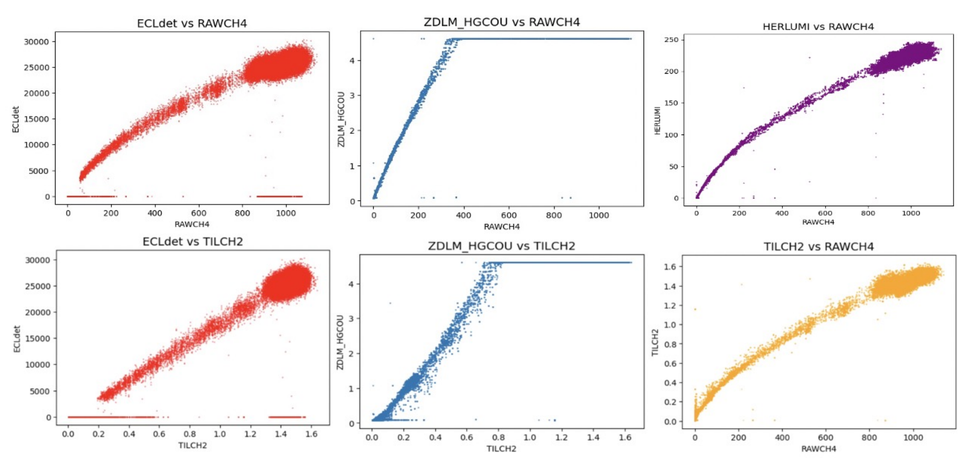
CURRENT SETUP

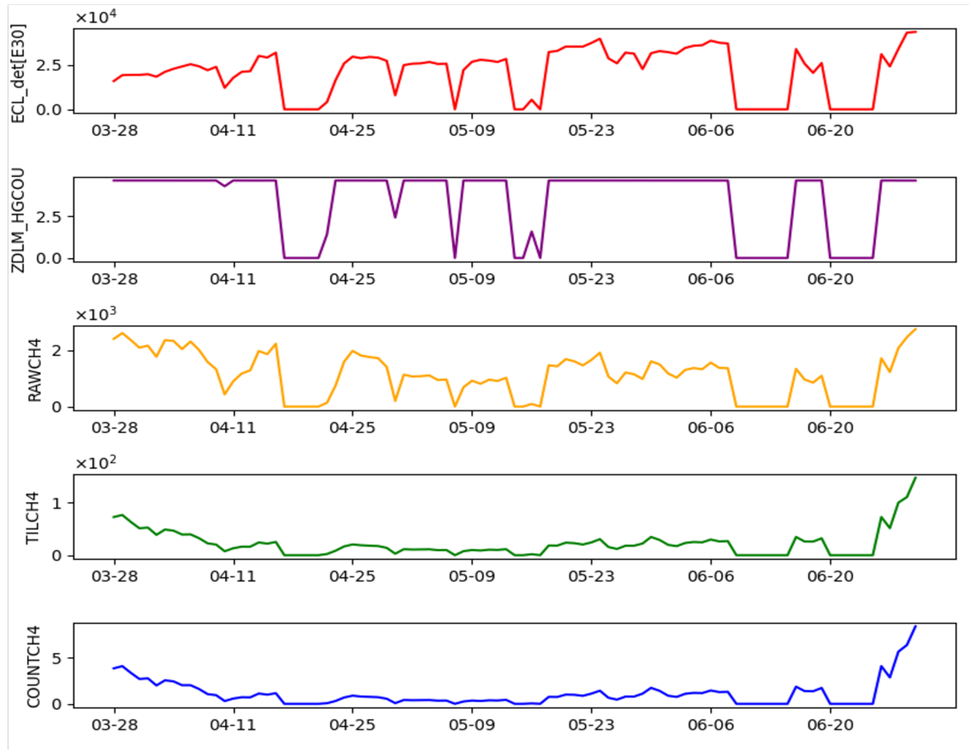


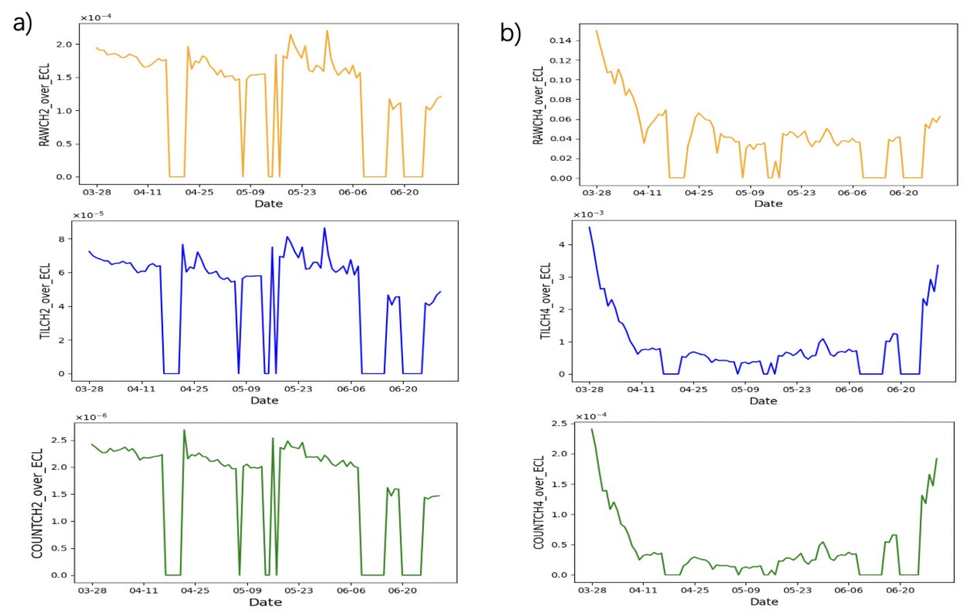
RESULTS IN 2024ab RUN

- **Train integrated luminosity signals**

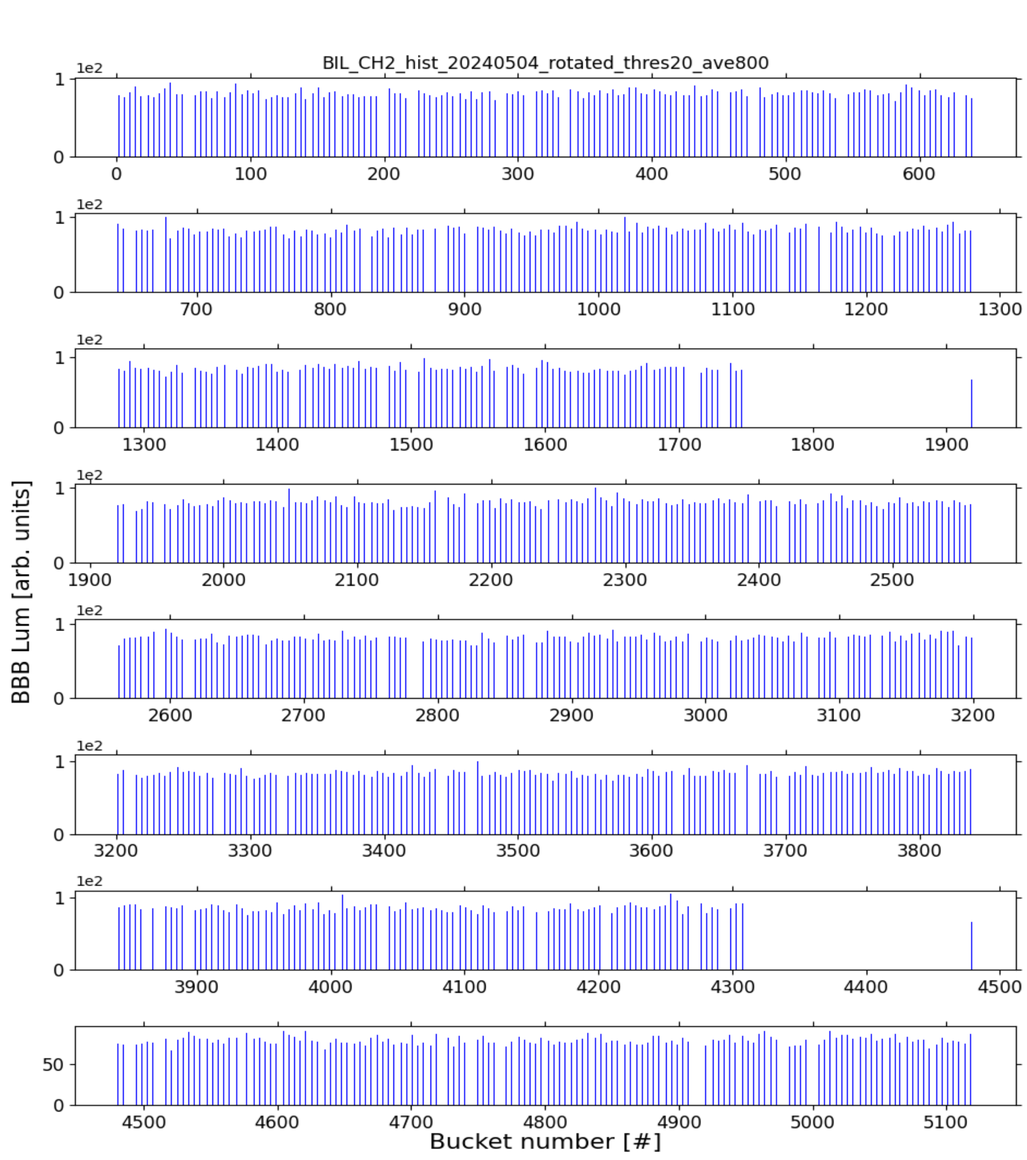








- **Bunch integrated luminosity signals**



Conclusion

The LumiBelle2 fast relative luminosity monitor of SuperKEKB operated successfully during the 2024ab run, providing useful signals for the tuning of the beams at the IP. A number of questions will have to be studied for the next runs, especially radiation damage issues for the diamond located nearest to the tungsten radiator in the LER, as well as a number of improvements to the data acquisition and data handling software.