Orbit Stability Improvement of Pohang Light Source

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PLS is a 3-rd generation light source whose beam energy and emittance are 2.5 GeV and 18 nm-rad. It has served as a synchrotron radiation user facility since 1995. At present, the electron beam is re-filled twice a day from the 2.5GeV electron linac, and the maximum stored current is 200mA. In order to improve the orbit stability, the major devices were upgraded in past two years such as corrector power supply and the BPM measurement system. The corrector power supply was improved to a 20-bit capability digital control power supply which uses FPGA and DSP architectures developed by PSI and DIAMOND.

A slow global orbit feedback can maintain the orbit stability in rms below 1 μm for one hour and 3 μm for one day in both planes. To reduce the fast orbit variation due to the insertion device gap changes, feedforward corrections of tune and orbit are working at the speed of 10 Hz. However, the photon beam position change was observed in beamlines during the beam-fills and it turned out that this is due to the false BPM readings coming from the vacuum chamber motion by synchrotron radiation thermal load change. The BPM chambers move up to 20 μm at most during the beam refills and the chamber motion has a time constant of about one and half hour, related to thermal equilibrium condition of vacuum chamber. To monitor the BPM chamber motion, LVDTs with 0.2 μm reading accuracy were installed on all BPM chambers, and the measured data are sent to control system every 1 minute to be used in the orbit feedback. BPM is the most important part in achieving the good orbit feedback performance. So the false BPM readings should be well dealt with by appropriate method.

In this paper, we will describe the result of orbit stability improvement activities carried out in past two years and how serious the BPM false readings are and how they are dealt with.