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Orbit stability and reproducibility at SOLARIS storage ring

Ensuring the stability of the electron beam at the SOLARIS synchrotron has been a key objective throughout its development. Several structural measures, including the installation of a vibro-elastomer mat and concrete block magnet girders, have effectively maintained the stability of the experimental hall within acceptable limits below 1.6um rms for low frequency range(below 10Hz) and below 0.3um rms in the frequency range between 10 and 50Hz. Thermal stability, particularly in the cooling water system, has been progressively enhanced, culminating in a major upgrade in 2022 that achieved a stability level of ±0.1℃.The orbit correction system has undergone significant improvements, with the Slow Orbit Feedback (SOFB) system being redesigned and accelerated by over an order of magnitude. Additionally, the successful development and implementation of the Fast Orbit Feedback (FOFB) system have further refined beam stability. To optimize performance, an offloading procedure was introduced, mitigating conflicts between the SOFB and FOFB systems.These advancements have enabled submicron precision in electron beam stability and reproducibility. While beam position reproducibility remains at a high level, the drifts of several micrometres over 12 h persist in the X-ray Beam Position Monitor (XBPM) readouts. Continuous efforts are being made to further enhance long-term orbit stability for the most demanding experimental applications.

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