Siam Photon Laboratory

Synchrotron Light Research Institute (Public Organization)

IMPROVEMENT OF THE SIAM PHOTON SOURCE BEAM LOSS MONITOR SYSTEM

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ABSTRACT

A description of the newly re-built beam loss monitor (BLM) system at the Siam Photon Source (SPS) is presented. The original BLM system was designed and installed in the 1.2 GeV SPS storage ring in 2005. The main problems of this system were poor performance due to RF electromagnetic interference and the use of now obsolete data acquisition electronics. The beam loss detector used is a PIN-diode type from Bergoz. The new BLM system has been implemented using low-noise coaxial cable and an acquisition system based on NI-PXI. The hardware and software modifications incorporated into the new BLM system are presented.

INTRODUCTION

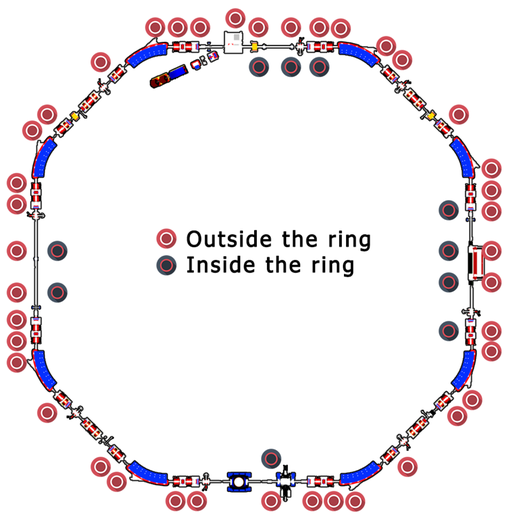
The existing beam loss monitor system (BLM) was designed and installed in the storage ring in mid-2005. The system was intended for measurement and analysis of the closed orbit distortion (COD) with beam loss rate and beam scraping of the vacuum chamber around the storage ring. It used PIN-diode BLMs from Bergoz. The acquisition and control electronics were based on a conventional PCI interface bus using standalone PCs. The major problems of that system were high RF interference in the BLMs and cables and the non-expandable, now obsolete control electronics.

The new system was implemented and subsequently improved in 2014. The major objectives of this improvement are to reduce and protect from RF electromagnetic interference and to better observe the unstable beam around the ring.

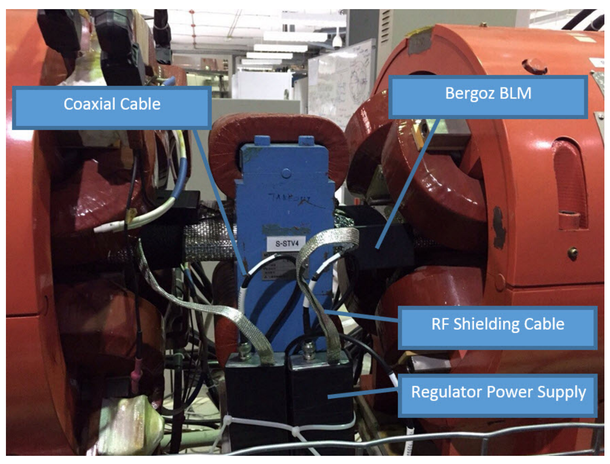
HARDWARE IMPROVEMENTS

Sensors and Power Supplies

There are 50 Bergoz's beam loss monitors each of which comprises of two pin-photodiodes operating in coincidence mode. The BLMs have been assembled and placed around the vacuum chamber in the storage ring. Regulated low noise power supplies (+5 VDC, -5 VDC, +24 VDC) for up to 10 BLMs is provided from each of 8 transformer units (+12 VDC, -12 VDC, +31.2 VDC) distributed around the ring. The power and signal cables between regulated power supplies and detectors are covered with RF shielding. Also the sources of the RF interference, our bump magnets, were shielded with copper.

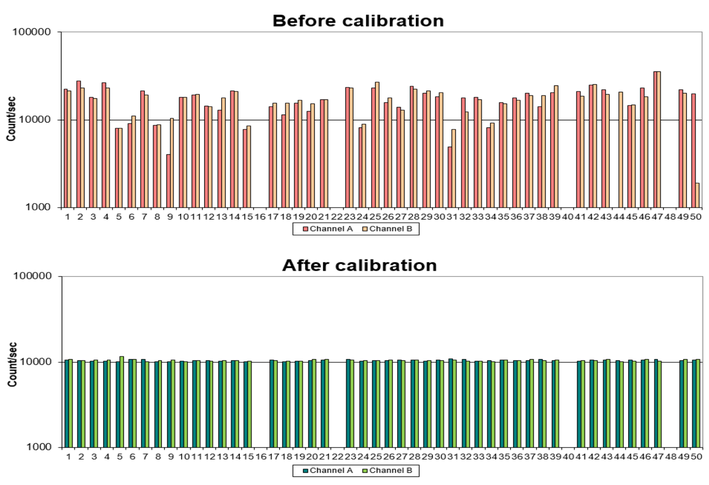


New SPS BLM positioning layout in storage ring.



BLMs with RF shielding.

All BLMs have been re-calibrated for background noise count rate with the new cables and acquisition system. Each BLM circuit was re-calibrated to within a spurious count rate of 10 kHz ±800 Hz as per Bergoz's manual.



The count rate of BLMs in test mode before and after re-calibration.

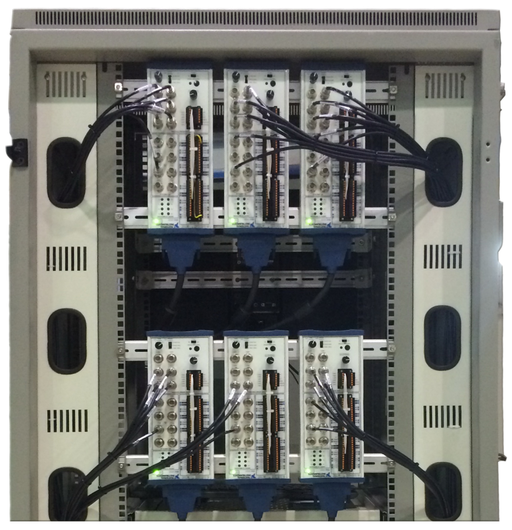
Signal Cables

We replaced the existing cables with HUBER+SUHNER model RG-223/U. This particular cable has double shielding, an impedance of 50 ohms, and operating frequency up to 6 GHz.

Acquisition System

All count signals from the 50 BLMs are collected by NI PXIe-6612 counter modules connecting to BNC terminal. They are based on National Instruments PXI Express platform (NI PXIe) instead of the NI-PCI 6602 counter cards previously used. There are 8 counter modules which are installed in an NI PXIe-1078 PXI Express chassis with a NI PXIe-8820 2.2GHz Celeron dual-core controller processor and 2 GB, 1333 MHz memory. The PXI is a rugged PC-based platform for measurement and automation systems. It is a high-performance, low-cost deployment platform, and is an especially expandable system for the future.

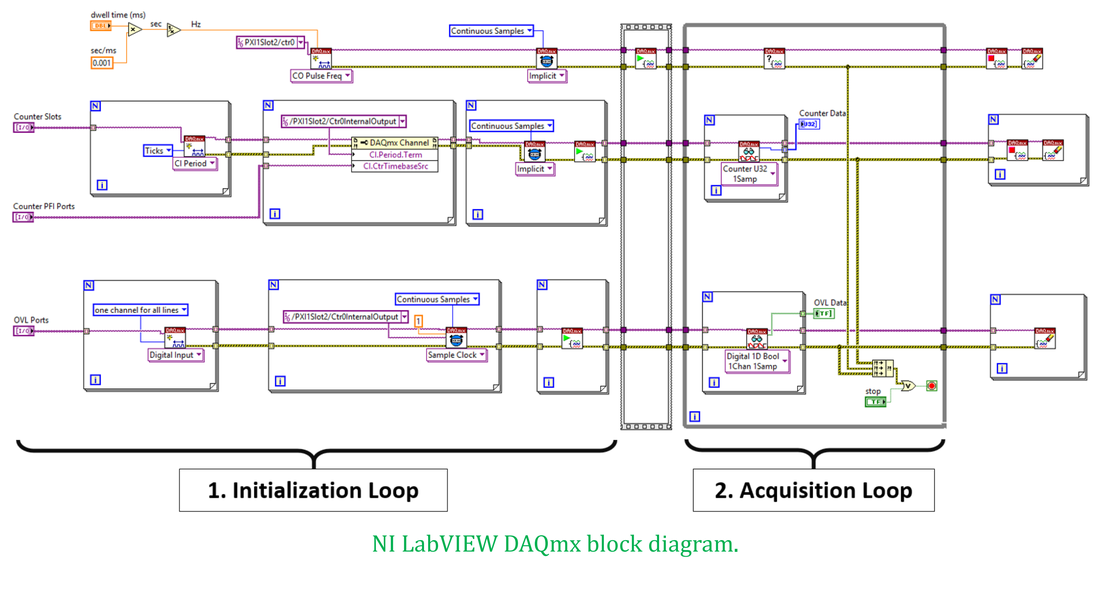
NI-PXIe classis and monitor on front rack.



BNC terminal boxes installed on rear rack.

SOFTWARE IMPROVEMENTS

In this system we use LabVIEW programming platform to collect and analyse input signal from BLM units. The PXIe-6612 counter/timer card from NI is programmed via NI DAQmx software. It first initializes and configures each card for counting up and then starts the counters in the cards. After that it reads data from each input channel at specific intervals, then analyses and displays the count rate.



NI LabVIEW DAQmx block diagram.

CONCLUSION

The improved SPS beam loss monitor system has proved to be extremely useful for machine study and beam loss diagnosis. It is an indispensable tool for our machine physicists for the task to improve the injection efficiency.

ACKNOWLEDGEMENT

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