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PII: S0263-2241(17)30003-9
DOI: http://dx.doi.org/10.1016/j.measurement.2017.01.003
Reference: MEASUR 4526

To appear in: *Measurement*

Received Date: 7 March 2016
Revised Date: 28 December 2016
Accepted Date: 2 January 2017

Please cite this article as: M. Shafiee, S.A.H. Feghhi, J. Rahighi, Experimental Performance Evaluation of ILSF BPM Data Acquisition System, *Measurement* (2017), doi: http://dx.doi.org/10.1016/j.measurement.2017.01.003

Experimental Performance Evaluation of ILSF BPM Data Acquisition System

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Abstract:

In order to have optimal functioning of particle accelerators, the control system requires a precise position monitoring of the beam and the performance of the concerning data acquisition system should be evaluated accurately. A configurable beam position monitoring data acquisition system is designed based on under-sampling theory in Iranian Light Source Facility. To evaluate the performance of this data acquisition system, after testing with synthetic signals, it is experimentally evaluated at ALBA accelerator facility. The measurement results show the precision of 0.54 μm in beam position monitoring. The measured resolution is around 0.1 μm due to the wide dynamic range of -90 dBm. Our overall results are indicative of the fact that the performance of beam position monitoring data acquisition system is quite well for the ILSF.

Keywords: button beam position monitor, Storage Ring, Data acquisition system, Under-sampling method.

1. Introduction

The Iranian Light Source Facility (ILSF) is a new 3 GeV third generation synchrotron light source facility which is in the design stage. The storage ring is based on a five-bend achromat lattice providing an ultralow horizontal beam emittance of 0.48 nm rad [1]. Beam position is one of the crucial parameters in a third generation synchrotron light source. In order to have desired operation and optimal functioning of the machine, the control system requires an accurate position monitoring of the beam [2]. Among the various methods of Beam Position Monitoring (BPM), the method of position measurement based on capacitive coupling to the electrostatic fields is vastly applied [3]. In this method, four BPM electrodes are placed in a symmetrical configuration. The induced charges on each BPM electrode are employed to measure the beam position. In these analyses, the most common method to measure the beam position is Δ/Σ algorithm [4].

To measure induced charges on BPM electrodes and consequently calculating beam position, a data acquisition system was developed in ILSF. To evaluate the performance of the developed BPM data acquisition system, first it is tested by synthetic signals at lab to measure the response linearity, resolution of system and beam current dependency. It is then installed on the ALBA storage ring [5] for experimental evaluation tests.

In the following sections, the ILSF BPM specifications and associated data acquisition system are described and the test results at ILSF [1] and ALBA [5] are presented.

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