Position Measurement of Beam Position Monitor for Magnetic Center of Sextupole

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1 . Introduction

Since four button electrodes of beam position monitors (BPM'S) in SPring-8 storage ring are welded on the straight section chambers, the position of all BPM's depends on the position of the chamber which is determined by the chamber alignment. Therefore, the position of BPM's fluctuates around the magnetic center of sextupole. Since the fluctuation remarkably deteriorates the accuracy of beam position measurement, the mechanical center of BPM for sextupole magnetic center was measured in accuracy of± 20μm.

2. Method of Measurements

In the BPM system of SPring-8 storage ring, the mechanical center of four button electrodes is specified by the distance from two BPM reference planes, which are at right angles and are fixed on the referenceblock mounted around button electrodes. Two kind of measurements were performed. Firstly the tilt angles (θ : Fig.1) of the reference planes were measured (θ-measurement). Secondly the positions (Δx Δy : Fig.1) of mechanical center of all BPM's were measured for sextupole magnetic center (xy-measurement).

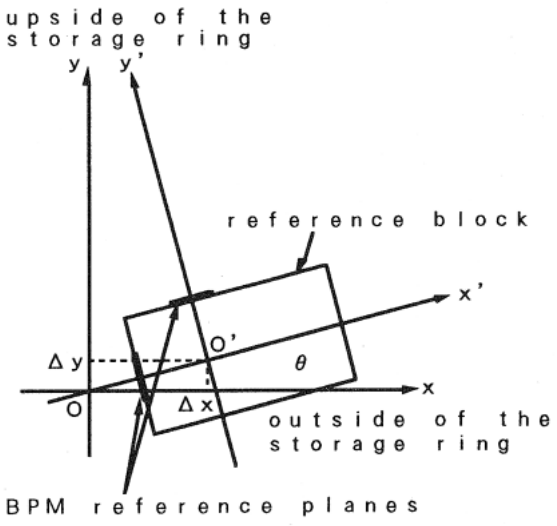

Fig. 1 Coordinate system of the BPM

O : Magnetic center of the sextupole
O': Mechanical center of the BPM
θ : Tilt angle of the referenceplane
Δx Δy : Coordinate of O' in the x-y system

(1) Method of θ -measurement

θ was measured by prism-coincidence precision level on the jig which was made of steel and was attached on the BPM reference planes.(Fig.2) The angle resolution of the precision level is 10 μrad.

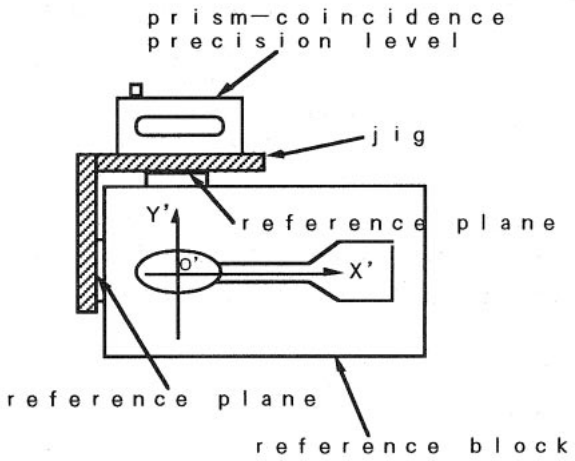

Fig. 2 Schematic view of e -measurement

(2) Method of xy - measurement

Δx and Δy were measured by use of a survey system for magnet alignment on girder which consists of a He-Ne laser, a CCD camera and a Macintosh computer for processing image data. [1] As shown in Fig. 3, the quadrupoles of both ends in a girder have fixed stage for targets on upper part of yokes. The quadrupole center is 500mm below the target center of fixed stage. The CCD camera was put on the fixed stages and the laser beam positions were read out. The fiducial line is defined by connecting two obtained points. The coordinate (Xc, Yc) from this fiducial line is obtained by putting the CCD camera on the jig which was attached on the BPM reference planes. Δx and Δy are calculated by the following formula,

$\Delta x = (Yc+L)\sin\theta - Xc\cos\theta - Xs$

$\Delta y = -Yc\cos\theta - Xc\sin\theta + L(1-\cos\theta) - Ys,$

where L=500mm and e is results of e measurement. Q(s, Ys) is coordinate of nearby sextupole magnetic center from the quadrupole magnetic center with fixed stage for target. This coordinate was measured in magnetic alignment on a girder. [1]

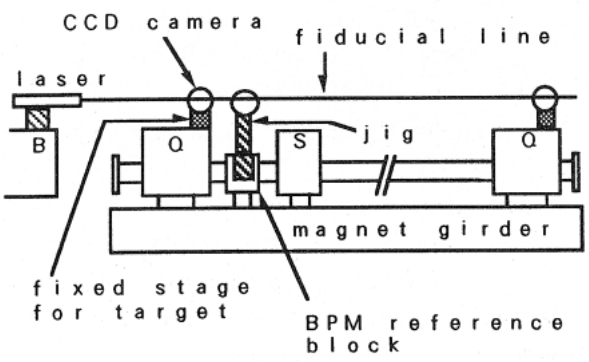

Fig. 3 Schematic view of xy - measurement
B : Yoke of bending magnet
Q : Yoke of quadrupolemagnet
S : Yoke of sextupole magnet

3. Results

Fig. 4 and Fig. 5 show the results of e measurement and xy - measurement respectively.

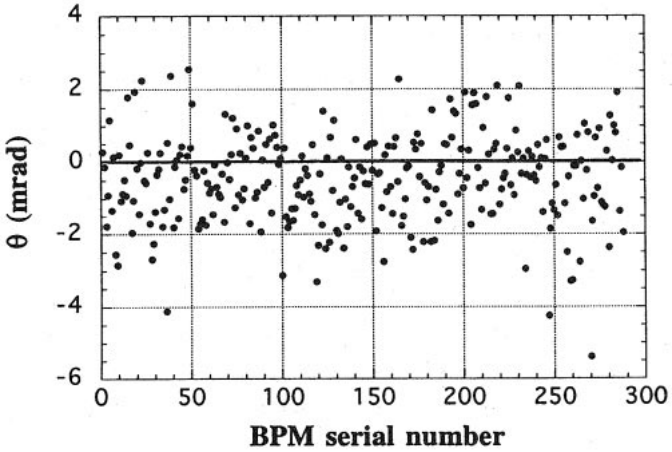

Fig.4 Results of 6 -measurement. BPMS are numbered in order of cells from the injection point. Total BPM number is 288. The average of absolute error is ±27μrad.

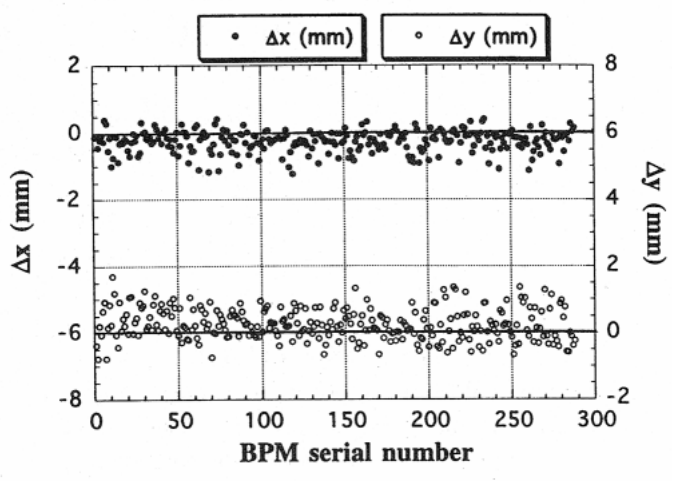

Fig. 5 Results of xy - measurement. The averages of absolute error are ±23μm for Δx and ±19μm for Δy.

References

[1] Y.Chida, S.Matsui and J.Ohnishi
KEK Proceedings 95-12 (1996) P.194
"Proceedings of the Forth International Workshop on Accelerator Alignment"