BEAM POSITION MONITOR FOR THE PF STORAGE RING AND ITS CALIBRATION SYSTEM

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Beam positions will be measured at 42 locations along the circumference of the PF storage ring for precise orbit correction. A position monitor has 6 electrodes to pick up beam signals electrostatically (Fig. 1). The structure and location of the electrodes are decided earlier in a design work.[1)]

In real machine operation, the signals will be handled as follows. The 500 MHz component of the beam signal will first be converted to a lower frequency to be amplified. After the signals being rectified, they will be used in calculation of beam position.

Calibration of each position monitor involves (1) finding a standard point as the origin of a physical coordinate system which will be used throughout the machine operation and (2) one-to-one mapping between the physical coordinates and the coordinates calculated by using the electrode signals.

To guarantee the physical coordinates, each position monitor will be firmly mounted ona pair of precisely machined arms to lessen its lateral movement with respect to a corresponding quad axis but it is allowed to move freely along the axis since vacuum chambers will be expanded during baking processes.

To obtain the coordinate mapping, all the position monitors will be tested with a calibration system which consists of a motor-driven x-y stage and a microprecessor unit interfaced to devices such as digital volt meters, stepping motors and a RF switch (Fig. 2).

Calibration data for a position monitor are obtained as a chart like in Fig. 3 which shows the coordinates calculated by using electrode signals corresponding to the physical coordinates. A beam position falling within a grid of 5 mm x 5 mm will be obtained by linear interpolation.

The system needs further to be refined for stabler and faster data taking to provide calibration data desirable for a position accuracy of 0.1-0.2 mm.

Reference

1) T, Katsura and S. Shibata, KEK-79-27 (1979)

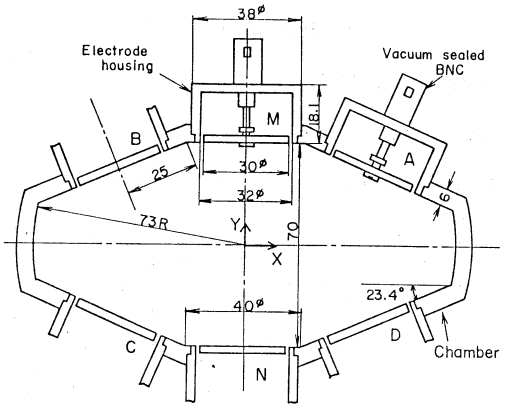

Fig. 1 Beam position monitor for the PF storage ring.

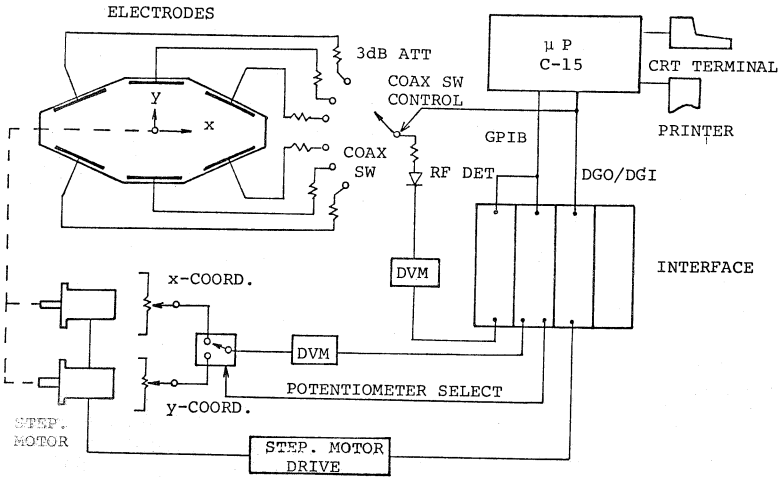

Fig. 2 Calibration system for the position monitor

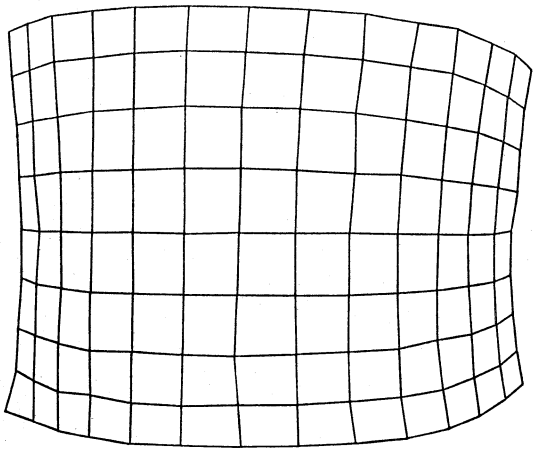

Fig. 3 Calibration chart with a grid size of 5 mm x 5 mm covering a 65 mm x 40 mm area inside a position monitor.