PROGRESS OF BEAM POSITION MONITOR IN KEK PROTON SYNCHROTRON

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The observation of the beam position in the accelerator is indispensable to steer the beam in a small vacuum pipe during the acceleration period. It offers the significant information to RF feedback system etc. The correction of the closed orbit distortion can not be accomplished without the information of the beam position.

The detectors to observe the beam position are classified into two. One is electrostatic pick-up and the other is electromagnetic one. We developed the former[1] and studied the electric characteristics during last year. In this study following defects were observed. There were anormalous noisy components in the signal. The noises in the signal were induced by RF signal and its harmonicses and were arised from the sudden change of the beam shape and position at the transition period. Moreover, the noises were induced in the signal transmission cable. The method to obtain the beam position data by subtructing between two analogue signals was too sensitive to the frequency characteristics of the long transmission cable.

It can be expected to reduce the coupling between the sources of the noise and pick-up by making the impedance of the pick-up lower using the electromagnetic pick-up. The reduction of the noise induced in the transmission cable can be performed by transmitting only the lower frequency fundamental component of the beam signal.

We developed a new type wall current pick-up as the beam position detector [2]. It has a inner pipe segmented into four parts as illustrated in Fig. 1. The segmentation of the pipe enables us to observe the horizontal and vetrical beam position, sumiltaneously. And it makes the inductance high so that the decay time constant increases to about 400ns. The wall current induced on each segment flows out to outer vacuum pipe through a rod, whose resistance is about 0.05Ω, and is picked up by the small transformer wound by Cu wire of 30 turns. The covar rod is metalized on the ceramic which seales the vacuum[3]. In this way the maintemances of the detectors are carried without the interruption to vacuum system.

The block diagram of the electric circuits is shown in Fig. 2. An amplifire, placed in the accelerator room, has a low pass filter (LPF) with high frequency cut-off of 11MHz and a rectifire. The LPF eliminates the high frequency noises and enables us to obtain a fundamental frequency component of the beam signal. The rectifire is used to pick up the signal caused from the beam position deviation from the closed orbit which is superimposed on the beam signal.

In the scheduled accelerator shut down in last summer, we installed 56 detectors around the PS. From November we studied the perfoemances of the detectors. The position error arised from the noises were lesser than o.5mm. The results of the measurements of the closed orbit distortion are shown in Fig. 3. The agreement of the measured distortion at the local orbit bump to the calculated one is very good. By using the electromagnetic pick-up and transmitting the low frequency component of the signal, overall accuracy of the system is improved to about 0.5mm.

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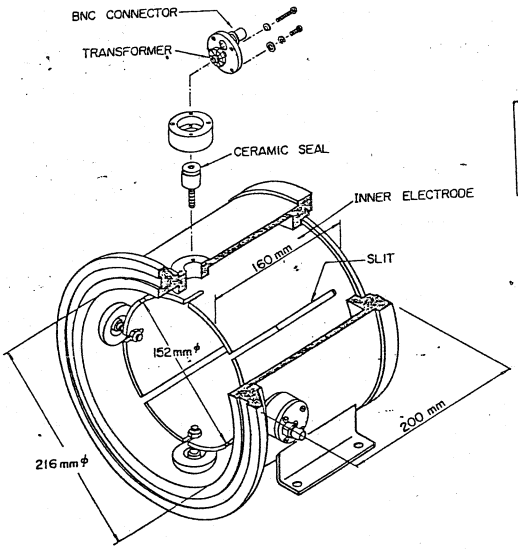

Fig. 1

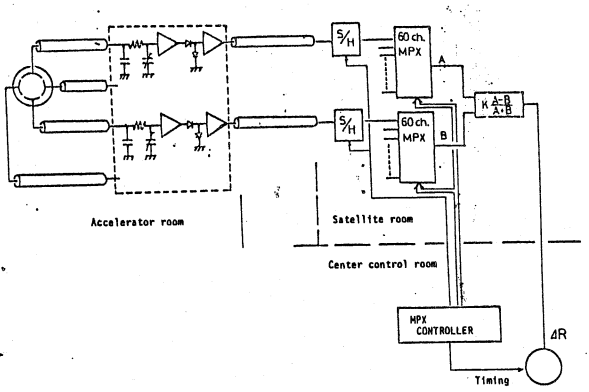

Fig. 2 Block diagram of the electric circuit

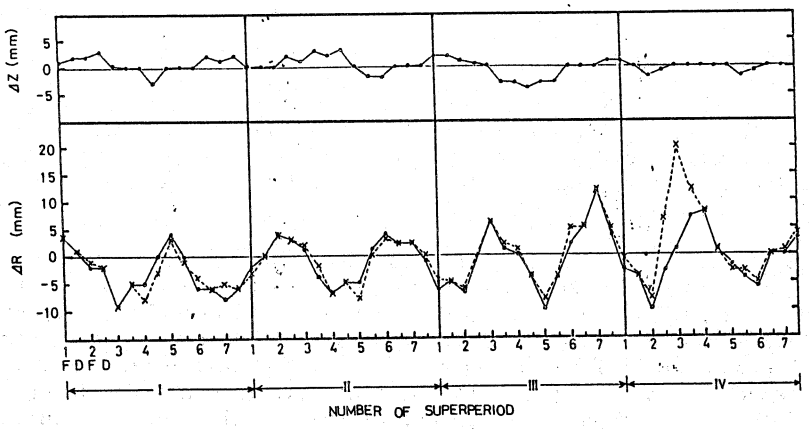

Fig. 3 Measured closed orbit distortion