BEAM DIAGNOSTIC SYSTEM FOR THE RIKEN SSC

Y. Yano, N. Kishida, A. Goto and N. Nakanishi
The Institute of Physical and Chemical Research

Abstract

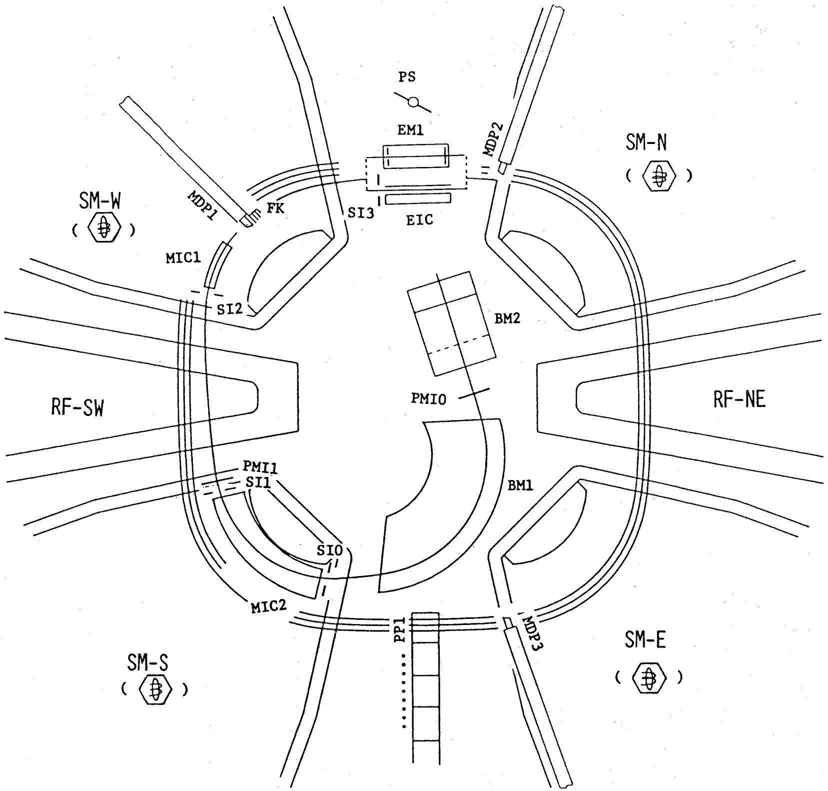
The general description of beam diagnostic system for the RIKEN SSC will be presented. We have determined the arrangement of beam diagnostic devices, considering the procedure of transportation and acceleration of the beam.

Beam diagnostic system for the RIKEN SSC

In the RIKEN SSC, the beam from the injectors is transported to the SSC, and is accelerated by it, and is transported to the experiment hall. In order to transport and accelerate the beam efficiently, it is essential to optimize the setting parameters of the beam handling devices by observing the beam properties at the appropriate position on the beam line and inside the SSC with various kinds of beam diagnostic apparatus.

As an example, the arrangement of beam diagnostic devices inside the SSC is shown in Fig. 1. With the aid of these devices, each element of the SSC is tuned up as follows. The setting parameters (position, current and voltage) for the beam injection apparatus (BM1, MIC2, MIC1 and EIC) are optimized by measuring the beam trajectory with the slit system (SI0-SI3) as well as the main differential probes (MDP1 and MDP2). At this time, the buncher voltage is adjusted so as to give the minimum bunch length by measuring the length with the Fork probe (FK) wich is attached to the MDP1. This probe has been developed at GANIL and is successfully used. It can observe the variation of the bunch length of accelerated beam inside the SSC. One of the features of our beam diagnostic system is that the emittance monitor (EM1) is installed at the beam injection point. Because the fringe magnetic field from the sector magnet (SM) exists in this area, the beam emittance is calculated on the basis of the magnetic field data as well as the data measured by the EM1. It can easily be done by using the above emittance monitor to match the beam emittance on six dimensional phase space with the desirable one. In one of the vacuum chambers, twenty pairs of phase probes (PP) of capacitive pickup type are arranged raially. These probes can observe the phase history of accelerated beam in a non-destructive manner. From the measured phase history, the currents of main coils and trim coils of the sector magnet are optimized so as to produce the isochronous magnetic field. The orbit center of acceleration orbit is measured by three main differential probes. We can obtain the two-dimensional position of orbit center. By observing the behavior of movement of the orbit center in the injection region, the voltage of EIC and the currents of injection harmonic coils are adjusted so that the orbit center may move to the machine center. The harmonic field is also applied in the extraction region to increase the turn separation and accordingly improve the extraction efficiency. The behavior of movement of the orbit center in the extraction region is observed again by the three MDP's and the currents of extraction harmonic coils are adjusted. The setting parameters for the beam extraction apparatus (EDC, MDC1, MDC2, EBM1 and EBM2) are optimized in the same manner as the injection case by measuring the beam trajectory with the slit system and the main and extraction radial prove (ERP).

The theoretical study of the adjusting procedures mentioned above is now in progress.



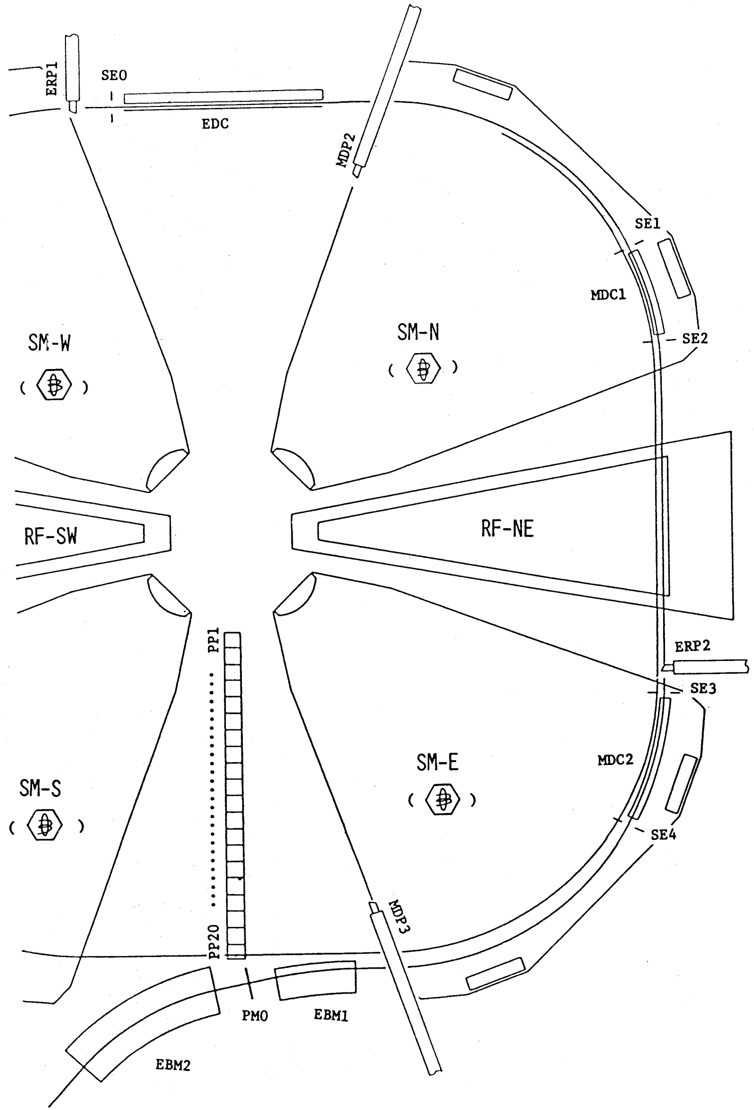


Fig. 1 The arrangement of beam diagnostic devices in the SSC.