A.7: Development of integrated diagnostics system for beam parameter measurement of Indus-2

In Indus-2 storage ring, measurement of beam parameters like betatron tune, synchrotron tune, longitudinal coupled bunch excitation, transverse coupled bunch excitation, and RMS beam orbit is important for optimisation of the machine performance. Earlier these parameters were measured independently due to the nature of measurements involved. The tune measurement system needs external beam excitation, whereas the coupled bunch mode measurement system is based on the natural excitation. Due to this, only one of the parameters among betatron tune, synchrotron tune, longitudinal coupled bunch excitation and transverse coupled bunch excitation could be measured at a time. During the ill condition of the machine, it is desirable to measure all the beam parameters simultaneously with data logging for proper investigation of problem and its correction for smooth operation of the machine. In this report, software development for integrated diagnostic system for beam parameter measurement of Indus-2 is presented. Beam Diagnostics Section (BDS) of Accelerator Control and Beam Diagnostics Division (ACBDD) has carried out this development.

The block diagram of integrated beam parameter measurement system is shown in Fig. A.7.1. The software is used for measurement, display and logging of betatron tune, synchrotron tune, longitudinal coupled bunch excitation, transverse coupled bunch excitation, and RMS beam orbit for Indus-2.
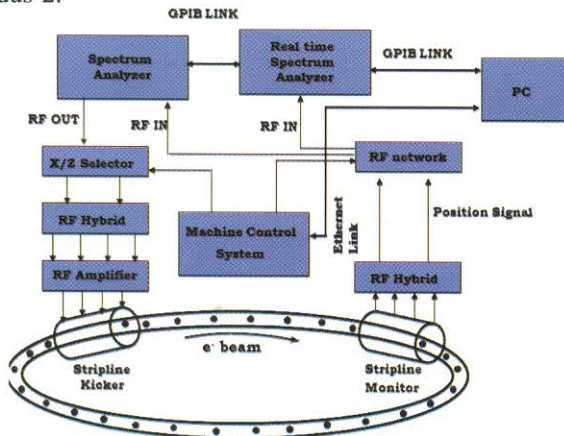

Fig. A.7.1: Block diagram of integrated beam parameter measurement scheme

The software acquires the beam position and beam intensity data in time and frequency domains. Signal processing techniques like point invariant concatenation of acquired data, low pass filtering, curve fitting, multi-peak detection etc. are applied on the acquired data to measure the

beam parameters simultaneously. Modular approach has been adopted for software development. Modules have been developed for individual type of beam parameter measurement and integrated so that the crosstalk of different measurements is minimized. With the development of this software, more than 800 parameters are monitored online and logged. The measurement time of this system is ~ 25 sec per measurement.

The software has been deployed in Indus control room for use by operation crew. A screenshot of the developed GUI is shown in Fig. A.7.2.
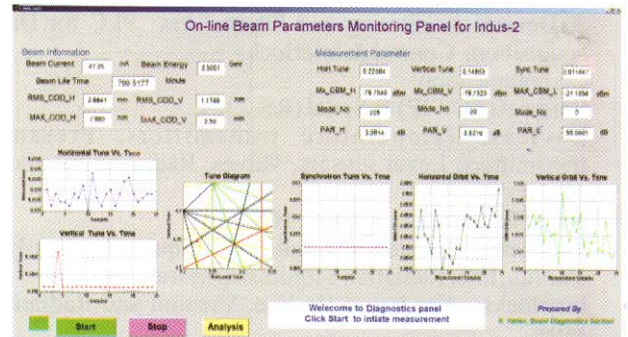

Fig. A.7.2: Screenshot of graphical user interface of measurement system

This system is being regularly used to get the information about beam operation stability and repeatability. The system has played an important role in beam loss control during beam energy ramping. Typical graphs of measurements are shown in Fig. A.7.3.
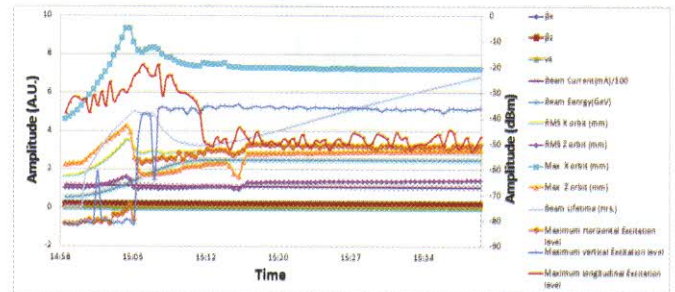

Fig.A.7.3: Typical measurement result during beam operation

The measurement of beam instability excitation level of different modes along with other beam parameters helps in optimization of the machine performance. During the high beam current trials, this software has helped in identification of beam excitation and machine parameters like tune and orbit value variation.

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