A.4: Average orbit drift correction in Indus-2 by RF generator frequency change

In Indus-2, control system is developed for correcting the average orbit drift resulting from the change of mechanical dimensions of the accelerator components due to day to day variation in average tunnel temperature. Fig. A.4.1 shows the scheme for this developed system.

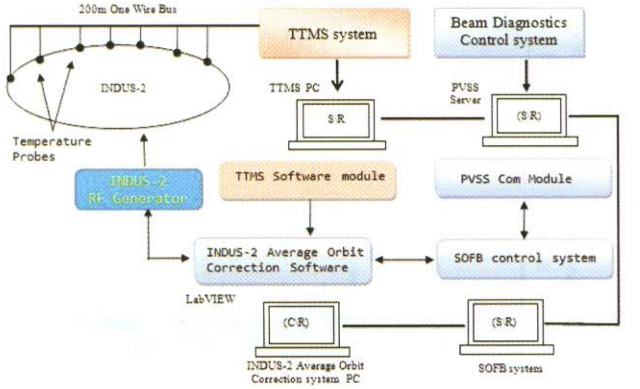

Fig. A.4.1: Control system scheme for average orbit drift correction in Indus-2.

The system comprises of Tunnel Temperature Monitoring system (TTMS) and Slow Orbit Feedback (SOFB) control system which publish the tunnel temperature data and beam position data respectively over TCP/IP along with various other system state information, newly developed LabVIEW software modules for communication with the RF generator over TCP/IP, control algorithm module, system control response simulation, data logging and graphical user interface modules. This system collects tunnel temperature data from 50 temperature sensors installed throughout the Indus-2 ring from TTMS system and horizontal beam position from beam position measurement system through SOFB control system interface. Using this information, the correction required in the RF frequency of Indus-2 is calculated and new RF frequency value is set to the RF generator after qualification of different interlocks.

The control software is developed with the features for online viewing of beam position at individual (Beam Position Indicator) BPIs, time average beam position at individual BPIs, reference beam position at individual BPIs, time average drift in beam position at all the BPIs along with the selected BPIs used for calculating correction by the control algorithm. A separate waveform chart is provided for evaluating the effectiveness of the control algorithm through online open loop control action simulation data \ actual closed loop correction data plotting along with the average tunnel temperature drift and effective weighted average horizontal orbit drift. The software has authentication based reconfigurable features for easy change of reference orbit definition, control algorithm coefficients, enabling /disabling of BPIs for participation in correction algorithm, RF generator settings, default RF frequency settings and maximum and minimum RF frequency limit settings, control loop-time settings, averaging filter settings, RF frequency dead band settings, position drift dead band settings and enabling\disabling of RF generator communication settings. Fig. A.4.2 shows the GUI for the average orbit drift correction system at Indus-2.

Fig.A.4.2: GUI snapshot of average orbit drift correction system in Indus-2.

The initial testing of the system with actual beam has shown encouraging results (Fig.A.4.3) where the system successfully maintained the generator frequency within ± 20Hz (frequency error) of the required value for 80 minutes of test duration. In the same time the RF Generator frequency varies by ~225 Hz and the average tunnel temperature varies by ~ 0.17 °C. Algorithm development for simultaneous operation of this system with SOFB in ON state is currently under consideration.

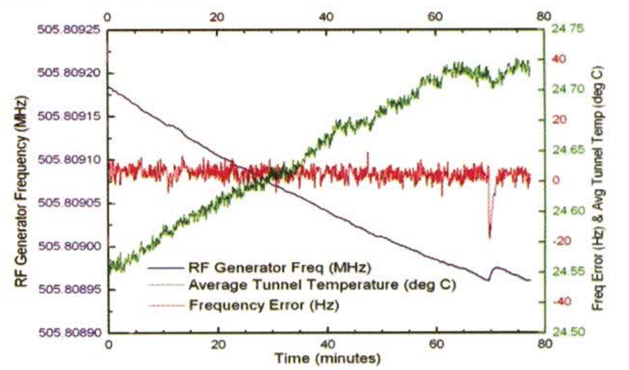

Fig.A.4.3: Initial test result of average orbit drift correction system at Indus-2.

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