A.5: Distributed ambient temperature monitoring system for Indus-2 tunnel

Electron beam orbit stability and photon beam quality in Indus-2 storage ring are important requirements from the point of view of synchrotron radiation users. The variations of average temperature of the ring tunnel cause changes in the mechanical dimensions of various machine components thus result in the shift in average beam orbit over time. In order to correct and minimise this average orbit shift, temperature dependent, pre- calculated and calibrated RF frequency change is usually done. To achieve this, it is required to measure and study the average orbit change with respect to tunnel ambient temperature variations. As a first step towards this, a distributed Tunnel Temperature Monitoring System (TTMS) is developed and installed in the Indus-2 ring. Figure A.5.1 depicts a schematic of the system.

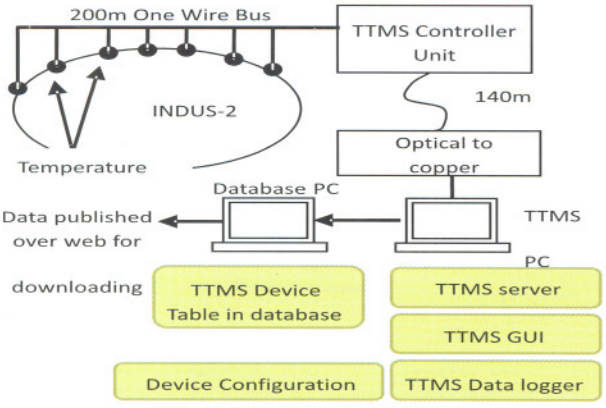

Fig. A.5.1: Scheme ofTTMS

The system comprises of fifty DS18B20 based temperature sensors installed throughout the ring (200 m length) using one wire bus in linear topology, Philips 89V51RD2 based custom developed TTMS controller with active one wire bus driver, optical fiber communication interface and application software with different modules installed over TTMS PC connected to the controller inside the ring using 140m long OFC.

Table A.5.1:TTMS hardware features

No of devices installed	50
Maximum no of devices possible	100
Sensor type	DS18B20
Sensor accuracy (-10 °C to +85 °C)	±0.5 °C
Sensor resolution	0.0625°C
Refresh rate (@ 12bit resolution)	1Hz
Maximum equivalent cable weight supported by active one wire bus driver	500m
In operation sensor replacement	supported

Table A.5.1 highlights the TTMS hardware system features and Fig. A.5.2 shows the TTMS controller and temperature sensor probe.

Fig.A.5.2:TTMS controller along with temperature sensor probe

The controller handles the communication with up to one hundred temperature sensors using one wire bus protocol. It collects the temperature data from all the sensors and sends it to SCADA server on receiving commands. It also performs the device handling functions such as device configuration, detection and error reporting. The embedded software for temperature controller is developed using in application programming (IAP) Application Programming Interface (API) to directly update the device ID table in microcontroller memory (ROM) thus facilitating easy replacement of faulty temperature sensorwith the new one and system reconfiguration. The SCADA system for the project is developed in LabVIEW framework with a modular architecture. It comprises of four modules - TTMS server module, GUI module, Data-logger module and Device configuration module. Fig. A.5.3 shows a screenshot of TTMS software GUI.

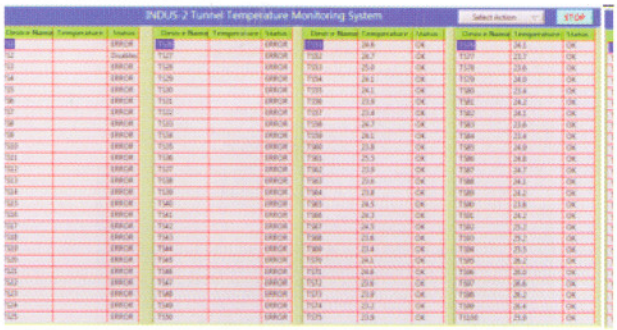

Fig. A.5.3: TTMS softwareGUI

The system is in continuous use and the data is being logged with one minute rate and is available over intranet for use by the concerned teams.

Reported by:
R.P. Yadav (rpyadav@rrcat.gov.in) and P. Fatnani