



A.2 Indus-2 beam line front end control system : Design, development & commissioning

Indus-2 is a third generation synchrotron light source with 27 beam lines planned for utilization of the synchrotron light. The equipment assembly called beam line front end (BLFE) is used to interface the beam lines with the Indus-2 ring. The BLFE fulfils the following important requirements:

1. Provides protections consequent to vacuum failure on either side (Machine or beam line).
2. Provides interlocks for the safety of sensitive front end devices.
3. Provides radiation safety interlock.
4. Provides the photon beam conditioning for beam lines.

In order to facilitate and co-ordinate the operation and control of the BLFE from the main control room, a control system has been built by the Controls Laboratory. The BLFE control system is based on the three-layer architecture of Indus-2 control system. The lowermost layer (Equipment Control (EC) layer) interfaces the signals from field devices; the middle layer (Supervisory Layer) collects all the signals and passes it to the uppermost layer, the operator interface layer.

The EC layer caters to approx. 600 signals, in all (400 status signals, 100 digital controls and 100 analog input signals). Beam Energy and Beam Current information can be provided to all the beam-lines from this system. The Supervisory Control And Data Acquisition (SCADA) software at the operator interface layer provides the graphical user interface (GUI), which shows the signals both in tabular as well as in a synoptic form. This software is designed on a client server model. The GUI server communicates with the middle layer using PVSS API manager over Ethernet and collects the data and computes system state variables. The API manager interacts with the hardware (layer-2 server) to get the data and set the physical devices. This periodically polls the L2 server to get current parameter values and set them in the PVSS database (DB). Engineering data value to physical signal value conversion and scaling is done in the API manager. When user wants to set/control any parameter, the corresponding value change is given to API which sends them immediately to L2. GUI server synthesizes present system state according to the system pre-selectable configuration and previous state variables of the system. Accordingly events are generated which trigger automatic actions and alarms.

All events and actions (either automatic or user initiated) are logged along with user name. All user actions need authentication. There are three levels of authentication, the first level provides the operation rights, second level

provides the configuration change rights on vacuum limits and third level is the administrator level. Alarms on device malfunction are displayed in the main Indus alarm panel as well as on the BLFE GUI panel with the device blinking to highlight the erroneous device. Presently few beam line controls are functional and others will be coming up in near future. The software is designed to allow the stepwise addition of the new upcoming beam lines with minimal configuration changes.

The control system provides the vacuum interlock by monitoring the vacuum level on both sides of the front end. It withdraws the open permission on gate valve GVI connecting the front end to the ring periphery to protect vacuum in case pressure increases beyond the set limit. There are separate limits for alarm generation and automatic action, which are user changeable. This is done with proper user authentication.

Radiation safety is assured by interlocking the safety shutter (SS) open permission with electron beam injection. When the electron beam is stored and ramped to the desired level the operator can give SS open permission to the beam line users after proper authentication. The radiation level is continuously monitored and software withdraws the SS open permission in the case of radiation exceeding the safe limits. The operation limits of SS for alarm generation and automatic action are provided to operator with authentication.

Various devices are protected against damage by continuously monitoring the system state and in case of system entering undesired state the software initiates the beam dump. The GUI panel and mimic for the BLFE are shown in Fig.A.2.1, A.2.2.

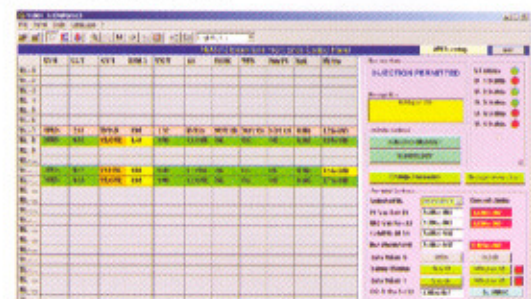


Fig.A.2.1: Main GUI Panel for BLFE control.

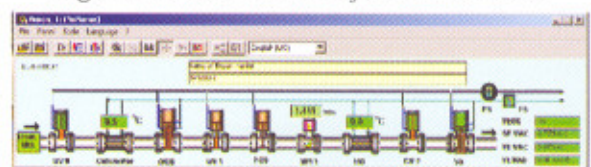


Fig.A.2.2: Synoptic view of a Beam Line Front End.

Contributed by:
P. Fatmani (fatmani@cat.ernet.in)