

A.3: Control system for Indus-2 insertion devices U1 and U2

In Indus-2 storage ring two planer undulators have been commissioned. The control system for both undulator U1 and U2 was developed and remote operation of undulators was successfully done from control room using software developed using LabVIEW. Special emphasis was given to planning and testing of various safety interlocks as it was for the first time, undulators were to be operated with electron beam. The control system was integrated with Indus-2 machine control system and tested for safe operation of Indus-2 machine in presence of undulators.

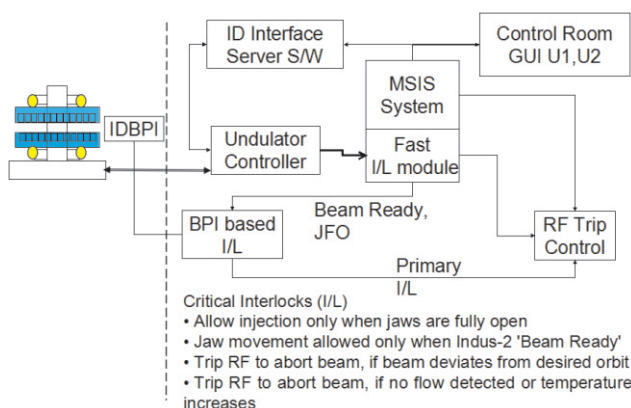


Fig.A.3.1: Block diagram of control system and interlocks for U1 and U2 undulators

The control system is architected as a distributed and modular as shown in Fig. A.3.1. It has an intermediate software layer to support simultaneous monitoring and control of U1 and U2 device controllers. The control system development included communication interfaces, protocol for communication, software and hardwired safety interlocks and it facilitated remote monitoring of various parameters. A dedicated ID server software was developed which interacts with both the undulators over accelerator network (AccNET) and provides necessary data to client GUI which runs in main control room.

The ID server software has various features such as automatically restricting the undulator controls by enabling the control room GUI in view only mode, thereby ensuring undulator jaws are not moved until the software receives 'Beam Ready' from the machine control system. This software displays undulator parameters, interlocks and alarms in the main control room GUI (Fig. A.3.2) and performs data logging. The interlocks are implemented in different layers of control system in machine safety interlock system (MSIS) and beam line front end (BLFE) control system.

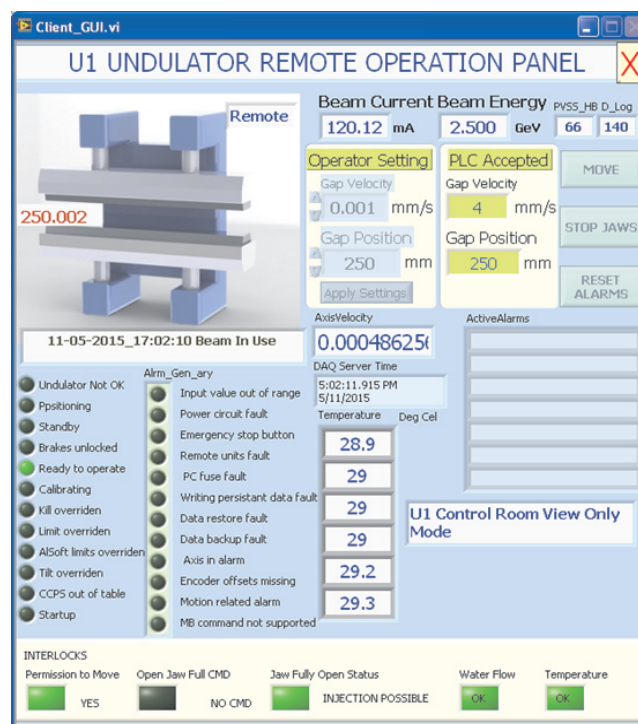


Fig. A.3.2: A screen shot of Undulator GUI

IDBPI based beam position interlock is enabled under certain machine states defined by 'Beam Ready' and 'Jaw fully open' (JFO) signal. It ensures that this interlock is effective under critical condition of beam mis-steering which might occur during undulator jaw movement.

Two independent Undulator controller racks (for U1 and U2) are installed on Indus-2 equipment gallery and the secondary racks are mounted on the undulator body itself. Equipment rack is connected to the secondary rack with an EtherCAT cable for communication. The hardwired interlock signals are connected from equipment rack to the machine safety interlock system (MSIS) rack using an 8-pair twisted shielded cable in fail-safe manner. On the MSIS rack a CPLD based fast interlock module (FIM) is mounted. This FIM keeps vigil on undulator interlock signals such as Undulator - OK, temperature and cooling water flow etc. The FIM asserts fast signal for tripping the Indus-2 RF in case any of the critical interlock fails. For safe operation of machine with undulators, various safety interlocks were developed, thoroughly tested and deployed. The control system facilitates safe operation of Indus-2 with undulators at all the stages of machine operation viz. beam injection, energy ramping and beam usage at 2.5 GeV.

Reported by:
Pankaj Gothwal (pgothwal@rrcat.gov.in),
and P. Fatnani