

A.11: Electron beam current limiting system for Indus-1

A system for automatic limiting of injection current in Indus-1 storage ring is developed, which stops the injection in the Indus-1 ring if the current is above the specified threshold limit. In the event of beam current crossing the specified current limit, the software takes action and stops the injection into Indus-1 ring.

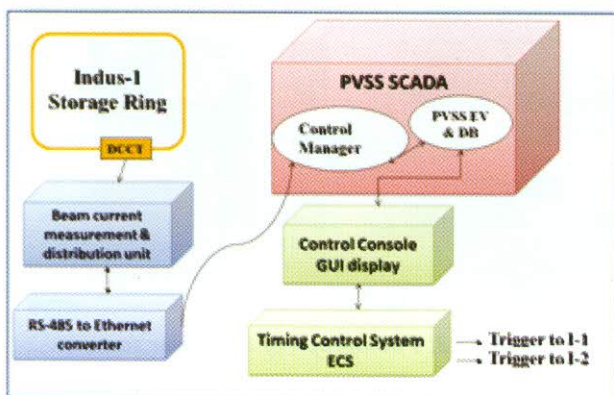


Fig. A.11.1: The architecture of the automatic current limiting system

Electrons for Indus-1 are extracted from booster with the help of extraction magnets and injected into Indus-1 using injection magnets. Timing system provides the trigger pulses for firing these kicker magnets/ power supplies. The injection stopping mechanism was chosen considering the associated radiation safety aspects. This was achieved by implementing a scheme in which the Indus-1 Timing Control System (I1-TCS) stops trigger signals for extraction of the beam from the Booster. A modification in the TCS Equipment Control Station (ECS) was done for providing a No Extraction Mode in which extraction from booster is stopped and no triggers are given to the injection systems of Indus-1 as well as Indus-2. The architecture of the system is represented in Fig. A.11.1.

Various modules developed for the system are described below:

PVSS Control Manager Module:

This module acquires the Indus-1 beam current from the existing Beam Current Measurement and Distribution Unit on RS-485 link. This module keeps on monitoring the beam current continuously and whenever it crosses the specified configurable threshold limit (presently set at 125 mA), the module sets a current_above_limit flag and stops the

extraction from the Booster by putting the I1-TCS in the No Extraction Mode and the extraction permission is disabled. When the beam current falls below the set hysteresis value around the threshold current limit, the extraction permission is enabled so that the user can make a request for beam injection again in Indus-1. There is a provision of selecting the extraction ring mode manually with authentication. The system has configurable threshold beam current limit and hysteresis limit on it.

I1-TCS GUI Panel:

The existing Graphic User Interface (GUI) panel of Indus-1 Timing Control System (TCS) is upgraded to provide display and control of these extraction modes (Indus-1, Indus-2 and No Extraction). GUI provides following features:

1. Color coded mode of the trigger outputs.
2. Line diagram of trigger outputs clearly indicating the state of the system interlock and extraction permission.
3. Displays a message when the injection current in Indus-1 has reached the specified threshold. In this case the extraction is stopped and I1-TCS is put in No Extraction Mode.
4. Displays messages in the message window whenever the normal/diagnostics mode is changed or the extraction ring mode selection is changed.

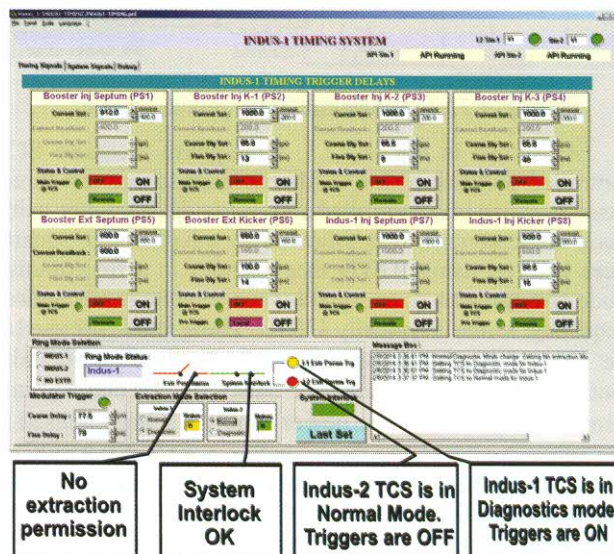


Fig. A.11.2: Indus-1 Timing Control System Panel

The system is deployed for regular operation and is working reliably for past 6 months. This system has been found very useful in the regular operation of Indus-1 machine.

Reported by:

R.K. Agrawal (ragrawal@rrcat.gov.in) and Kirti Barpande