A.1: Status report on operation of Indus accelerators

The synchrotron radiation (SR) sources, Indus-1 and Indus-2, constituting a national facility, maintained very good operational performance during the second half of 2021 (July-December). Post 2nd lockdown due to COVID-19, the Indus facility was restarted in June, 2021 and round-the-clock operation of Indus-1 and Indus-2 was resumed with SR beam available for users.

In the said period, both the machines were operated smoothly following the prescribed safety procedures. Figures A.1.1 and A.1.2 show the typical user mode operation of Indus-1 and Indus-2, respectively. Two planned shutdowns of four and five days each were taken in the months of August and November, respectively for preventive maintenance. Starting on 6th December, a longer shutdown of 3 weeks was taken for installation of horizontal pinger magnet in Indus-2 and various other upgradation and maintenance activities. Taking this into account, the machine was operated in round-the-clock mode for 154 days during these six months. The beam availability in Indus-1 was 3264 hrs. (~21 hrs./day), whereas in Indus-2, it was 2600 hrs. (~17 hrs./day). This performance is largely in line with performance in recent years. The maximum beam lifetime in Indus-2 at 100 mA @ 2.5 GeV increased further to 116 hrs.

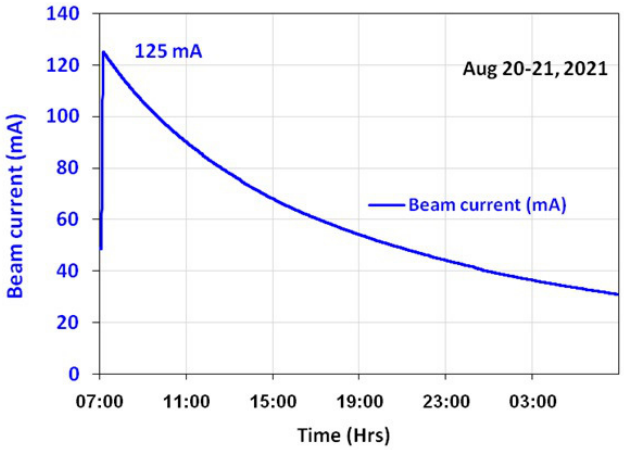

Fig. A.1.1: Typical user mode operation of Indus-1.

Several measures have been taken for containing the spread of COVID-19 during operation of the facility like improving ventilation of the Indus complex through additional exhaust fans, installing UV based air purification devices in Indus Control Room, AHUs and washrooms, online meetings of coordination committee, etc.

Utilization: Users from various universities, research institutes and national laboratories used the SR beam at beamlines in Indus-1 and Indus-2 for carrying out experiments. The total number of user experiments carried out at Indus beamlines was 365.

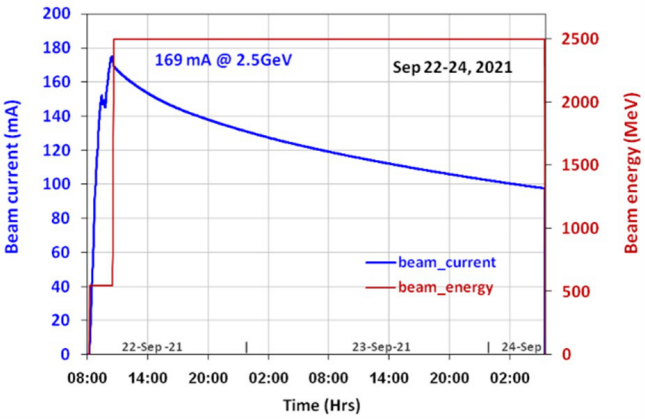

Fig. A.1.2: User mode operation of Indus-2.

Installation of Horizontal Pinger Magnet in Indus-2 and other upgradation/maintenance activities: After installation of vertical pinger magnet in 2019, as a next step, horizontal pinger magnet was successfully installed in straight section LS-4 of Indus-2, along with its ceramic UHV chamber, pulsed power supply and timing control system (Figure A.1.3). A long shutdown of three weeks was taken in Indus machines during December 6 to 26, 2021 for this major upgradation. Both these pinger magnets shall be used as diagnostic tools for carrying out advanced beam dynamics studies. The installation required venting of VS-3 vacuum segment, comprising one eighth of Indus-2 ring. Alongside, six existing beam position indicators (BPIs) in VS-3 were also replaced with their upgraded versions. After integration of ceramic chamber and BPIs in the ring, UHV condition in VS-3 was restored after bakeout and vacuum conditioning.

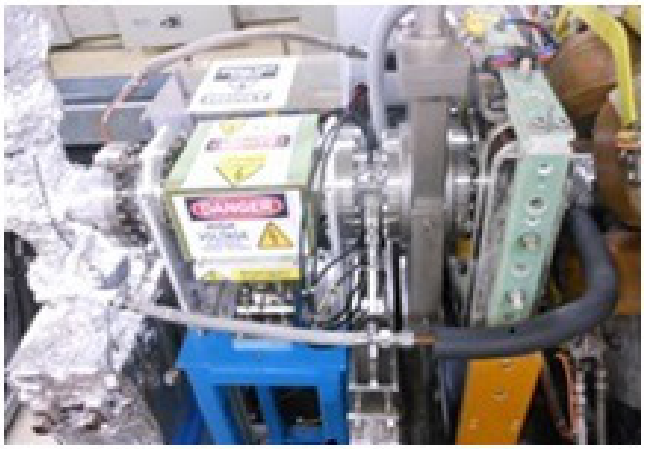

Fig. A.1.3: Horizontal pinger magnet installed in Indus-2.

Several other upgradation and maintenance activities were also carried out during this shutdown, prominent ones among them are: (i) installation of modified RF cavity in injector microtron, (ii) upgradation of low level RF system (LLRF) of booster synchrotron and Indus-1 storage ring with digital LLRF system.

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