

A.1: Status report on operation of Indus accelerators

The synchrotron radiation (SR) sources, Indus-1 and Indus-2 were operated in round-the-clock mode at 450 MeV energy/125 mA current and 2.5 GeV energy upto 200 mA, respectively, and these machines, constituting a national facility, provided SR beam to the users (Figures A.1.1 and A.1.2) regularly. In the said period, both the machines were operated reliably and smoothly on 163 days and following the prescribed safety procedures. Apart from the planned shutdowns for upgrades and preventive maintenance of total 18 days, there were no major breakdowns/shutdowns in the machine during this period. The beam availability for users was 3532 hrs (~22 hrs/day) in Indus-1 and 2716 hrs (~17 hrs/day) in Indus-2. Users from various universities, research institutes and national laboratories used the SR beam for carrying out experiments. The total number of user experiments carried out at Indus beamlines was 512.

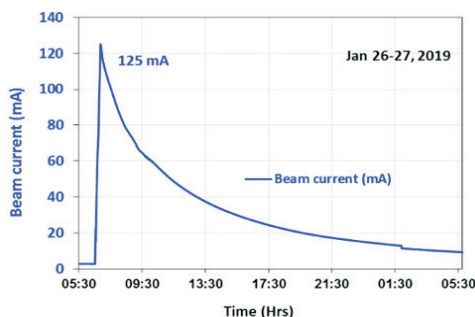


Fig. A.1.1: Typical user mode operation of Indus-1.

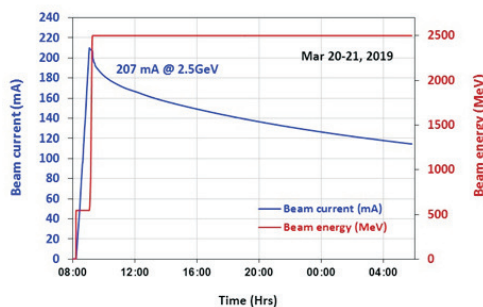


Fig. A.1.2: Typical user mode operation of Indus-2.

Improvement in Beam Life Time: During planned shutdown in December, 2018, maintenance of Indus-2 UHV system was carried out to attend a few minor vacuum leaks in the weld joints of dipole chambers. Furthermore, slow orbit feedback correction was extended in the horizontal direction, in addition to the vertical direction applied earlier. These measures resulted in significant improvement in beam life time at 100 mA/ 2.5 GeV from ~45 hrs to more than 65 hrs in

January, 2019, and gradually to ~70 hrs in April 2019 (Figure A.1.3). This performance of Indus-2 in terms of lifetime is the best achieved so far, and is repeatable. This increase in beam lifetime has helped users to plan long duration experiments with stable photon beam without significant drop in the electron beam current. The beam lifetime in Indus-1 has also improved to more than 6 hrs at 100 mA current as a result of optimizing the betatron tune of the machine.

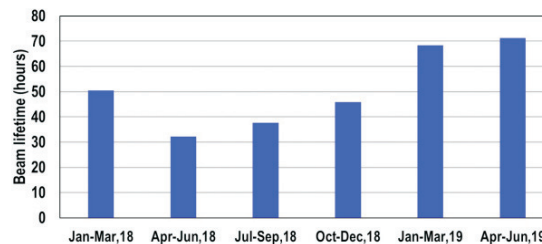


Fig. A.1.3: Quarterly data of maximum beam lifetime in Indus-2 during 2018-19 at 100 mA/2.5 GeV.

Machine studies: On twelve operation days (two in each month), reserved for machine studies, experiments were carried out for analysis and performance improvement of the machines and its sub-systems. Some of these experiments are as under.

- (1) The Longitudinal Multibunch Feedback (LMBF) system was tested and deployed for the first time in Indus-2 to suppress the longitudinal instabilities in the electron beam. Soon it will be available for regular operation.
- (2) Experiment on beam injection with the help of different bunch filling patterns was performed as a possible measure to address transverse bunch instabilities. In these experiments, beam current accumulation was smooth up to 215 mA with 256 bunches distributed in two bunch trains, without putting on the Transverse Multi-Bunch Feedback (TMBF) system. With this, beam current of 150 mA was also successfully ramped to 2.5 GeV, without any significant beam loss. In usual filling pattern with 150 bunches, saturation occurred at 150 mA without TMBF system.

Commissioning of new Beamlines: The “Beamline for engineering applications (BL-2)” and “Small and wide angle x-ray scattering beamline (BL-18)” were commissioned in Indus-2. The beamline BL-10 on undulator U2 of Indus-2 is regularly operated for optimization up to 140 mA of beam current, with pole gap to a minimum of 36 mm.

Training, Qualification and Licensing (TQL) programme: The fourth TQL programme for Indus operation staff was completed in June, 2019. Twenty nine staff members at various levels completed the training and were awarded new licences. More details about the TQL programme can be found on page 65 of this Newsletter.

Reported by:
A. C. Thakurta (thakurta@rrcat.gov.in)