



From the Director's Desk...

It is my privilege to bring to you this year's second issue of RRCAT Newsletter. This publication has been the result of the meticulous work of the editorial team in comprehensively highlighting the progress of the Centre during the period January – June 2019. The editorial team has put dedicated efforts to present to you a fair glimpses of the progress on all fronts viz. technological advances, scientific research, societal applications, education and scientific eco-system.

The National facility of indigenous synchrotron radiation sources - Indus-1 and Indus-2 have continued the round-the-clock operation during the period January – June 2019 for 163 days and 18 days were reserved for planned maintenance and upgradation. The upgradation of Indus -1 & 2 has improved the beam life time to ~70 hrs. at 100 mA/2.5 GeV (Indus-2), and to ~6 hrs at 100 mA/0.45 GeV (Indus-1). This has been the best achieved beam life time so far. During the period, 512 experiments were performed by diverse users, including users from pharmaceutical industries. These user experiments have resulted in publication of nearly 100 research papers in peer reviewed journals. Two new beamlines - “Beamline for engineering applications (BL-2)” and “Small and wide angle X-ray scattering beamline (BL-18)” have been commissioned in Indus-2, thereby the total operational beamlines in Indus-2 has reached to sixteen. The indigenous diagnostics beamlines for Indus-2 - “Visible diagnostic beamline (BL-23)” and “X-ray diagnostic beamline (BL-24)” have been established to measure the parameters such as beam size, beam emittance, bunch length, bunch filling pattern etc. utilising synchrotron radiation. These diagnostic parameters provide on-line continuous behaviour of accelerator beam that are essential for studying the accelerator performance and continuously evolve means to improve the performance of Indus-2. One of the *Theme Articles* gives the design details of these beamlines, and also the experimental results obtained.

Application of accelerators for societal use is a vital mandate of the Centre. A milestone of inaugurating a facility in February 2019 has been achieved with two indigenously developed 10 MeV, 5 kW electron linacs (Linac-1 and Linac-2) for medical sterilisation by e-beam irradiation. One of the *Theme Article* in this issue highlights the development of linacs, infrastructure and processing equipment that has been carried out for the radiation processing facility.

An initial demonstration of a compact external RF antenna-based H⁺ source has been done at 16 mA H⁺ pulses at 50 keV of 2 ms with 2 Hz repetition as front-end for proton accelerators. And, a Horizontal Test Stand (HTS) cryostat has been fabricated and installed to test superconducting radio frequency (SCRF) cavities at cryogenic temperature, before installing them inside cryomodule of the linear accelerator.

Noteworthy progress has been made also in the area of lasers and materials research. An indigenous fiber coupled pulsed Nd:YAG laser system was developed for *in-situ* laser cutting, which was used successfully to remove L-8 coolant channel of 540 MWe TAPS-4 reactor. *In-situ* laser cutting was a challenging task because of extremely narrow space available around the coolant channel for operation in presence of high radiation field. In the area of laser plasma acceleration (LPA), interesting experimental studies have been performed to demonstrate radiography of metallic and plant samples using the electron beam generated by LPA process. The initial development of carbon aerogel supercapacitor as an electrochemical energy storage device has attracted further work by researchers of the centre. The laser biomedical application has seen two important contributions in development of health care - OncoDignoScope and TuBerculoScope; a *Theme Article* in this issue, discusses the details of such photonics-based devices.

The fifth Orientation Course on Accelerators and Lasers, Young Scientist Research Program–2019, the second batch of Trade and Apprenticeship Scheme at RRCAT are some of the important programs conducted in order to impart education and training. The fourth Training, Qualification and Licensing Program was also concluded during this period, where 29 staff members completed the necessary training for Indus operation. DAE-SERB school on ultra-high intensity laser plasma interaction, RRCAT-NPCIL interaction meeting on laser based technologies in nuclear reactors, and discussion meeting on indigenous development of high power lasers for various applications are some of the important meetings that took place in the Centre.

My hearty congratulations to Shri P. K. Kush, for the lifetime achievement award for the outstanding contributions in the field of cryogenic engineering by Indian Cryogenic Council and to Shri Subhomay Halder for getting the Young Scientist Award in 34th Madhya Pradesh Young Scientist Congress.

I sincerely express my appreciation to Chairman, convener and members of the Editorial Board in showcasing a wide spectrum of activities of our Centre and bringing out the Newsletter with a fresh new look.

With best wishes,

December 17, 2019

Debashis Das
Director