From the Director's Desk....

The Indus-1 and Indus-2 synchrotron radiation sources are national facilities for advance research in various fields of science and technology. Both these synchrotron radiation sources have been operating and are being used by the researchers in the round-the-clock mode : Indus-1 at 450 MeV energy, 100 mA current, and Indus-2 at 2.5 GeV energy, up to 150 mA current. The up-gradation work on various sub-systems of Indus-2 is in progress. The output power of the solid state RF amplifiers has been further increased to 225 kW. A bunch-by-bunch feedback system has also been installed for controlling the transverse coupled bunch instabilities. As a result, the Indus-2 current could be increased to more than 180 mA at 2.5 GeV energy. Two planar undulators designed to provide photons with much higher brightness in VUV and soft x-ray region will be installed in Indus-2 towards the end of this year. Six beamlines installed on Indus-1 and twelve beamlines on Indus-2 are being used by researchers from several universities, IITs, IISERs, national R&D institutes like PRL, IISc, BARC, TIFR, IGCAR, UGC-DAE-CSR and RRCAT.

The Centre is pursuing vibrant R&D activities related to high intensity proton linacs for DAE's long term programme on spallation neutron source and accelerator driven sub-critical systems. These linacs will require a large number of multi-cell superconducting RF cavities operating at different frequencies. Single-cell prototype 1.3 GHz niobium cavities have been developed and tested under the framework of Indian Institutions Fermilab Collaboration (IIFC). Recently, a 650 MHz single-cell niobium cavity was fabricated and it has achieved accelerating gradient of 19.3 MV/m with quality factor of 7×10^{10} at 2K. Both these parameters exceeded the rated specifications.

In the area of lasers too, a number of important & innovative advancements have been made. A 215 W rugged all-fibre single mode Yb-doped cw laser-amplifier system, a new model of industrial Nd:YAG laser with dual port fibre optic beam delivery with 1 kW average power (20 kW peak power), and a compact pulsed soft x-ray laser (operating at 46.9 nm) based on a high voltage capillary discharge, have been developed. Several interesting applications like synthesizing a photo-sensitizer and its trial for photo-dynamic therapy of cancer, laser-driven ion acceleration at ultrahigh intensities, fabrication of titanium structures with different porosities using laser rapid manufacturing, laser shock peening on the ZrNb alloy relevant to coolant channels of nuclear reactors, *in situ* laser cutting of bellow-lip weld joint without removal of peripheral obstacles, hand-held photon counting based uranium analyzer for rapid measurement of trace uranium in potable water etc. have been developed.

The R&D activities in the frontline areas of lasers and accelerators have resulted in new synergies and novel technology developments at the Centre. Laser welding of niobium superconducting cavities is one such example. This technology, developed for the first time in the world, offers many advantages over the conventional electron beam welding, especially as it permits welding in an inert gas atmosphere instead of vacuum, produces a much finer weld with little distortion, with much smaller capital and operating cost. The first laser-welded single-cell 1.3 GHz niobium cavity tested in September 2013 has exhibited an accelerating gradient of 31.6 MV/m, with a quality factor of 10^{10}, at 2K.

Human resource development activities at RRCAT have been greatly enhanced by extending the available research facilities for training of the university students in the areas of accelerators, lasers and their applications. At present, 30 external students are carrying out research work at RRCAT for their Ph.D. degree under the framework of Homi Bhabha National Institute. Opportunities are also provided to the M.Tech / M.Sc students from all over the country, to carry out their one-year / six-month project work towards partial fulfilment of their degrees. During last year, 130 such students pursued their project work at RRCAT.

In the end, I wish to compliment the members of the Editorial Board for their sustained excellent efforts in bringing out the Newsletter periodically, highlighting the latest developments at the Centre.

With best wishes

April 16, 2014

P. D Gupta

(P D Gupta)
Director