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Production of the first photo-electron from the RF Photo-cathode electron gun of Delhi Light Source

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A compact THz-FEL facility, named as Delhi Light Source (DLS), is being commissioned at Inter University Accelerator Centre (IUAC), New Delhi. The facility consists of RF photocathode electron gun, high power RF system, the nano-second solid state laser system to be replaced soon by the femto-second (fs) Fibre laser system, the Undulator magnet, the Photocathode deposition systems, various electromagnets, the beam transport and the beam diagnostic devices.

The energy of the first photocurrent electron beam produced in 2022 was limited to be ~ 1.0 MeV as the forward power from the Klystron couldn't be increased beyond 1 MW in absence of a circulator. The long awaited SF6 based circulator was installed in the RF system in July '22 and presently the electron gun has reached a forward power of 5 MW after prolong RF conditioning.

During February '23, the electron beam was transported through the Undulator and the energy of the electron beam was measured to be 4.5 MeV (the maximum target energy is 8 MeV) by using the bending magnet (designed, developed and characterized at Bhabha Atomic Research Centre) when the cavity produced an accelerating field of ~ 65 MV/m at a forward power of ~ 4 MW.

At present, substantial effort is dedicated to perform rigorous RF conditioning of the cavity and to successfully complete the development and commissioning of the femto-second (fs) fiber laser system which is presently being developed at KEK, Japan. It is expected that by the end of this year, the accelerating field of the cavity will reach beyond 100 MV/m and the fs laser system will be installed at IUAC. The Undulator which was already tested and made operational, will be also operated to produce the first THz radiation.

Initiative is taken to develop the experimental groups and to perform experiments by using the electron beam and THz radiation in near future. A few pilot experiments by using electron beam and THz radiation are also being planned.

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