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OVERVIEW OF THE CRYOGENIC SYSTEM FOR VECC E-LINAC

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Content :

The proposed ANURIB (Advanced National facility for Unstable and Rare Isotope Beams) project at VECC will use a 30/50 MeV, 100 kW superconducting electron linear accelerator (e-Linac) as a photo-fission driver [1]. For this e-Linac a 10 MeV injector cryo module (ICM) has been developed in collaboration with TRIUMF laboratory in Canada. The ICM houses one 9-cell niobium radio-frequency (SRF) cavity operating at 1.3 GHz and 2K. An accelerator cryo-module housing two such cavities will take the beam energy to 30 MeV.

The cryogenic system for the e-Linac at VECC follows the design at TRIUMF for the ARIEL [2] facility. The cryogenic load for the e-Linac is considered for an acceleration gradient of up to 14 MV/m. 4 K liquid helium (LHe) from the cold-box of helium liquefier is brought to the cryo-modules via liquid nitrogen (LN₂) cooled transfer lines. The 4 K LHe is cooled down to 2 K inside the cryo-module with active sub-atmospheric helium pumping at 30 mbar. The 4 K – 2 K unit inside the cryo-module comprises a 4 K reservoir, J-T valve, heat-exchanger and a trunk feeding 2 K helium to the cavities that also acts as 2 K phase separator. The unit also supplies 4 K helium to the thermal intercepts whereas the main thermal shield of the cryo-module is LN₂ cooled. The heart of the cryogenic system is a new 500 watt LR280 Helium Liquefier plant for which order has been placed with Linde Cryo-Teknik.

The ICM will be installed in a e-Linac test area set-up at VECC. The cryogenic plant will be installed on the roof of the e-Linac test area and cryogen will be brought down from roof cut-outs into the ICM. A cryo-module test area is also being set-up in adjacent RIB annex building for initial testing of the ICM and later for testing the accelerator cryomodule and cryo-modules of the heavy-ion linac. The liquid helium line delivering cryogen to both locations has been tendered.

In this report the details and present status of the cryogenic system of the 10 MeV injector will be presented.

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