DAE-BRNS

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Book of Abstracts

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Plenary Talk

Overview of Accelerators and other Scientific & Technological Activities at VECC

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VECC is one of the premier R&D organizations under the Department of Atomic Energy (DAE). It is primarily engaged in the area of research in basic sciences since its inception in 1969. The major activities of the centre are: (a)Experimental research in low and high energy nuclear physics using accelerators and theoretical nuclear physics; (b)Accelerator based applied research in the field of material science and radiation damage studies; (c)Societal applications of Medical Cyclotron for the production of radioisotopes; (d)Indigenous development of accelerators and related components along with R&D on advanced accelerators; and (e)Technology development on RF/SRF, Cryogenics, Detectors, DAQ, power electronics, instrumentation, precision mechanical engineering, Computer & IT services etc.

A brief presentation on current operational status of two research oriented cyclotrons and also Radioactive Ion Beam facility will be made. The discussion on societal applications of Medical Cyclotron Facility being operated at VECC will be carried out. The major activities on experimental nuclear physics and radiation damage studies using cyclotrons will be presented in this talk. Besides these, the development of various technologies related to accelerators and its subsystem, will also be highlighted.

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Plenary Talk

Status report on the particle accelerator programme at BARC

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BARC has programmes on proton, ion and electron accelerators. The Low Energy High Intensity Proton Accelerator (LEHIPA) is a 20 MeV normal-conducting proton linac with a 50 keV ECR ion source, a 3 MeV Radio-Frequency Quadrupole (RFQ) and four Drift-Tube Linac (DTL) tanks to accelerate the beam to 20 MeV. Recently, beam has been accelerated through the first DTL tank to over 6.8 MeV. The peak beam current was 2.5 mA, in 200 μs pulses at 2 Hz. Beam transmission through the DTL tank was measured to be 93%. A Fast Faraday Cup was used to measure the bunch length to be 250 ps. BARC also participates in the Indian Institutions and Fermilab Collaboration (IIFC). Under this collaboration, BARC has developed (in collaboration with IUAC, New Delhi), two Single Spoke Resonator (SSR-1) cavities, one of which has been successfully used to accelerate beam at the PIP2IT test facility at Fermilab, USA, and was one of the best-performing cavities of all eight SSR1 cavities used. BARC also developed eight 325 MHz, 7 kW solid-state RF amplifiers that were used to power all the SSR1 cavities used at PIP2IT. All the transport line quadrupole and corrector dipole magnets used at PIP2IT were also developed by BARC. In addition, Low Level RF (LLRF) and RF Protection Systems (RFPI)

Abstract ID119

Efficient Low- Temperature Refrigeration System for Diffusion pump baffle cooling of K-130 Cyclotron.

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Two numbers of Diffusion Pumps (DP) with a capacity of 42,000 LPS each working in Room Temperature Cyclotron beam lines at VECC, Kolkata. These are used to create a vacuum (10^{-6}Torr) that facilitates to reduce of the back streaming in DP and improves the vacuum at beamlines. In order to cool down, the baffles of DP a two-stage cascade type refrigeration system developed in-house and installed. In this system, two vapor compression refrigeration cycles are thermally connected, using zero O.D.P (Ozone Depletion Potential) refrigerants R404A/R-23 combination. It is noted that the emplacement of a chilled water pre-cooler (PC) in the second stage discharge line enhances the efficiency of the system. Also, the overall coefficient of performance (COP) of the system is more when it is compared to other similar systems. This low-temperature refrigeration cooling is more cost-effective than LN_2 cooling, for the continuous operation of Cyclotron. This cascade-type refrigeration system has been maintaining a continuous low temperature (-70°C to -80°C) at the D.P. baffle uninterruptedly.

Abstract ID120

Design Study of Radio Frequency Cavity for Compact Superconducting Medical Cyclotron

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Conceptual design of a 12.5 MeV compact superconducting medical cyclotron for medical isotope production is presently under progress in VECC. This cyclotron will accelerate H- ions to an energy of 12.5 MeV with beam current of 50 µA. Physical dimension of the RF cavity of this compact superconducting medical cyclotron is constrained by design of magnet of the cyclotron, which is designed for 3.5 T and consists of superconducting solenoid coils surrounded by iron pole and yoke which are conductively cooled with a pulsed tube cryocooler. Region of Dee and some portion of the dee stem is constrained in vertical direction and scope of access in this portion is very less. Considering these constraints, initial design of RF cavity for Compact Superconducting Medical Cyclotron project has been carried out. Using 3D Electromagnetic solver , RF cavity has been optimized for different RF parameters like frequency, quality factor, shunt impedance etc. Power dissipation in different parts of the cavity and location of trimmer and coupler and their variation have also been studied and optimized.
