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Directors' Message

Several impressive technological developments have taken place at VECC, recently. While some of these developments will assist in basic research, others will, eventually benefit the society.

The current issue of VECC Newsletter showcases some of these interesting developments, like that of the Superconducting Magnetic Energy Storage System which is capable of providing clean and environment friendly power, the Plasma-based Beam Micro-Machining System that has application in selective ion implantation and device modifications, as well as the Mobile Robot that will help in displaying the radiation maps in the cyclotron vault and experimental caves. The design of low-cost, high-resolution gamma imaging device by the Computer and Informatics Group will aid in diagnosing certain cancerous cells in human body. In addition to these technological developments, the current bulletin also communicates several important events like theme meeting on physics issues to be pursued with our Superconducting Cyclotron, International Conference on Quark Gluon Plasma organized by the Centre at Goa, VECC-FAIR collaboration meet, etc.

R K Bhandari
(Director)

Editorial

Dear Reader,

The current issue of the VECC Newsletter focuses on several technological developments such as the development of micro-machining system for maskless milling and high precision deposition, the superconducting magnetic energy storage system for stable power supply, the mobile robot for radiation mapping in the critical area like cyclotron vault and experimental caves, design of high resolution gamma imaging device and the prototype calorimeter for India-based neutrino observatory.

Other important communique of the present issue is the theme meeting on the physics utility of the superconducting cyclotron and the 6th international conference on physics and astrophysics of quark gluon plasma organized by the centre at Goa. VECC has been the centre of attraction for young scientists and engineers and the centre has nurtured them well. Like previous years DAE has recognized these talents by awarding them recently. We take this opportunity to congratulate all the DAE awards recipients.

Happy Reading,

Editorial Board
VECC Newsletter

TECHNOLOGY DEVELOPMENT

Development of Superconducting Magnetic Energy Storage System

The Power Quality is one of the major issues in power distribution systems. Many critical machines, industrial processes, cyclotrons and other accelerators, especially those controlled by computers are sensitive to any voltage sag (dip) or short interruptions in the utility supply line. These disturbances in supply can increase the down time of the machine and hence the cost of production. This rising demand for a high quality power supply has resulted in a growing interest in superconducting magnetic energy storage (SMES) system. The SMES system is a clean and environment friendly attractive system having the ability to mitigate short time voltage fluctuations and sag (dips), which adversely affect down time of a machine or critical load.

In a SMES system, energy is stored in the form of magnetic field generated by the dc current flowing through the superconducting coil. The stored energy (E) and the rated power (P) are related by

$$E = \frac{1}{2} L I^2 \text{ and } P = dE/dt = LI(dI/dt) = VI,$$

where,

L is the inductance of the coil, I is the dc current flowing through the coil and V is the voltage across the coil. To maximize the stored energy, the current flowing through the coil is to be made as high as possible. This is the principle behind the SMES systems. If kept within the critical parameters (Jc, Bc, Tc), a superconducting material has zero resistance to dc current. Thus, the current can be increased to high values for a superconductor storing a significant amount of energy in the coil. Various laboratories all over the world are actively involved to develop energy storage systems spanning a wide range from laboratory prototypes to large-scale systems. With experience gained by realization of large superconducting cyclotron magnet and related cryogenics, VECC has ventured on taking up a challenging task of development of SMES systems.

The basic layout of a typical SMES system is shown in Fig 1. A prototype unit (~0.6 MJ) has been developed with the existing facility available inhouse. The prototype will be primarily used for developing the technology of power conditioning system (PCS) required for SMES technology.

The detail design of NbTi based cryostable and solenoid type 0.6 MJ SMES coil has been carried out and fabricated in house (Fig 2), assembled inside a standard magnet dewar with all related instrumentation, quench detection and protection systems. Quench detection circuit has been developed in house and air cooled dump resistor has been designed, installed with the system and tested successfully. The coil of around 800 kg cold mass

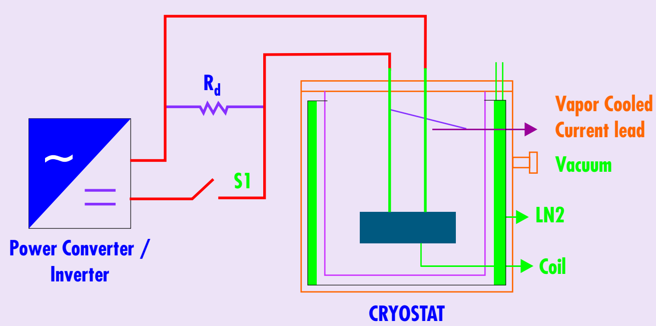


Fig 1 Basic lay out of SMES system

Fig 2 Prototype SMES coil during assembly in cryostat

has been cooled down to its operating temperature of 4.5 K and rigorous cryogenic testing has been performed. Sufficient stability margin has been kept while designing so that the coil does not undergo any quench during fast ramp down. High temperature superconductor (BSCCO-2223) based current leads that reduce the heat load to the system significantly have been designed, fabricated and tested.

The PCS with the energy storage capability working as a Dynamic Voltage Restorer (DVR), which being the most effective and viable solution for improving the voltage sag of the electrical utility supply, is shown in Fig 3. The major components of the PCS consist of rectifier and dc-dc Chopper for charging and discharging of the SMES coil, a voltage source inverter (VSI) for mitigating the power line sag, passive filters for suppressing unwanted harmonics, injection transformer and DSP based control and instrumentation for voltage sag detection and mitigation. Development of all these subsystems is in progress at the centre.

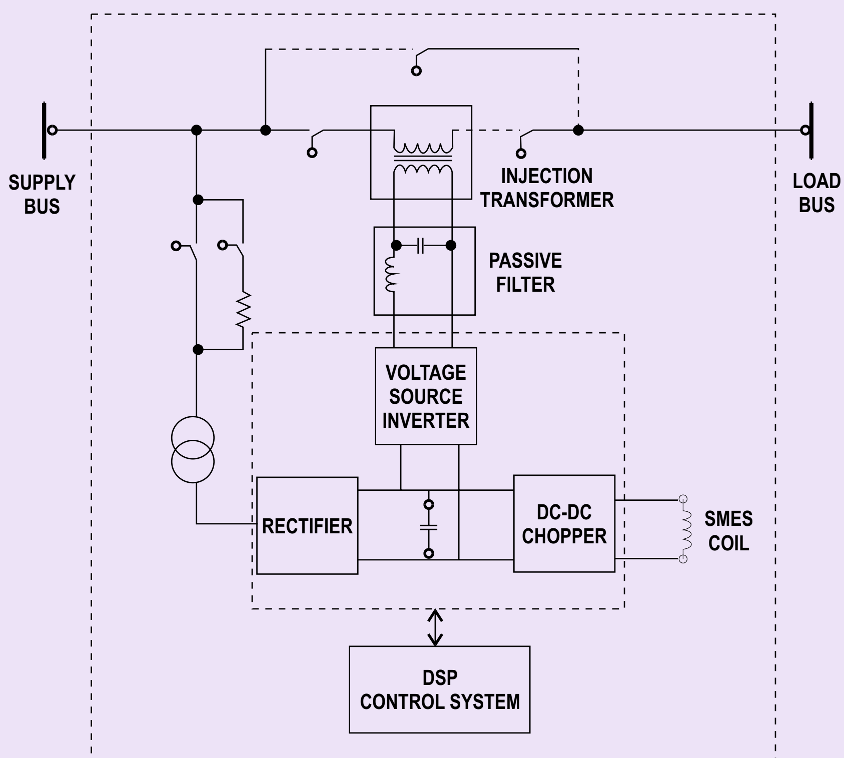


Fig 3 Power conditioning system using SMES

Development of Plasma Based Ion Beam Micromachining System

Focused ion beams (FIB) are widely used in milling the surfaces in nano and microscales. This technology enables maskless milling and deposition with high precision and hence proved to be very useful method for selective ion implantation, device modification, repair and failure analysis. The design of FIB system based on field emission ion sources is well researched and such systems are available commercially. However, they offer ion beams of only metallic species and thus the substrates treated with these beams gets contaminated changing its properties. With these sources, only few nA current can be focused to tens of nanometres dimensions due to very low angular current densities. As the current is increased beyond 10nA, the beam dimension increases rapidly, drastically reducing the available current density on the target. To overcome these limitations of conventional micromachining systems, plasma based FIB systems that can produce ion beams of all gases are being developed. The plasma ion source has 3 order higher angular current density and hence making it more suitable for high speed milling applications in micron scales. Although plasma based ion sources have definite advantages, it is complex to focus the beam to micron / submicron dimensions. The complexity stems from the fact that the source which is imaged by series of lenses changes its size and position depending on plasma parameters and extraction parameters. Generally the source size is of the order of ~10μm and hence the focusing column needs to have demagnifaction factors of the order of 10 - 100, as against the demagnification factor of near unity in case of field emission ions sources based FIB systems.

Recently a program is undertaken to indigenously develop the plasma source based FIB system at VECC. Major characteristics for the ion source to fulfill the requirements of micromachining applications are: high brightness, low energy spread, long life time, long term stability and capability to produce ions of various elements. A 13.56 MHz inductively coupled radio frequency ion source is the most suitable one for micromachining applications satisfying all the conditions mentioned above. In VECC, a compact, air-cooled ion source made of quartz plasma chamber of 25 mm diameter and 55 mm long, with an external 5 turn copper helical antenna is designed. Fig 1. shows the RF ion source with Argon plasma operated at 100W of RF power. Ion source is mounted on the vacuum chamber and inside which the ion beam focusing column is assembled. Entire assembly is mounted on vibration isolation system as shown in Fig 2. The ion source has double plasma chamber to facilitate the ease of initiation of plasma in the presence of tight Faraday shielding at RF powers as low as

Fig 1 RF ion source with Argon plasma

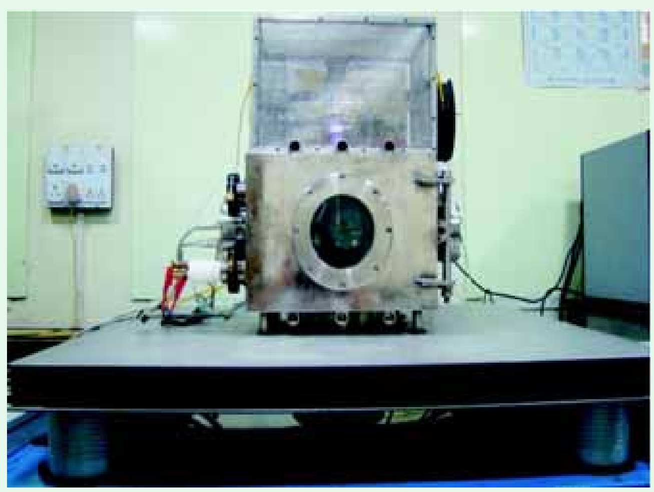


Fig 2 Ion source with vacuum chamber mounted on vibration isolation platform

200W. Moreover, small plasma volume generates higher plasma density at given power as compared to larger plasma chambers giving rise to increased extractable ion current. A unique feature of this ion source is that, it has no plasma confining magnetic field, making the ion source very simple and air-cooled. A plasma diagnostics by using Langmuir probe have shown that the plasma at 150W of RF power, has a density of 10^{11} - 10^{12} /cm^3. With an in-house developed electrostatic emittance scanner and focusing type retarding field energy analyzer RMS emittance of better than 0.03 mm-mrad and energy spread of less than 4 eV have been measured. Source brightness is experimentally determined to be better than $1x10^4$ A/m^2-Sr-eV.

The ion beam is focused using two einzel lenses. An aperture of 250 μm diameter is used to chose the central core of ion beam for minimizing the chromatic and spherical aberrations. Focusing column can be tuned to operate the system in either high current mode or high resolution mode. Performance of the FIB system is shown in Fig 3. Ion beam dimensions were measured by scanning the sharp steel knife edge across the beam and recording the Faraday cup current as a function of the position of the knife. This gives the integral of the current density distribution as shown in Fig 4. Differential of this distribution gives the ion beam profile. This figure shows ion beam diameters corresponding to 10%-90% and 20%-80% rise distances are 2.68 μm and 1.5 μm respectively.

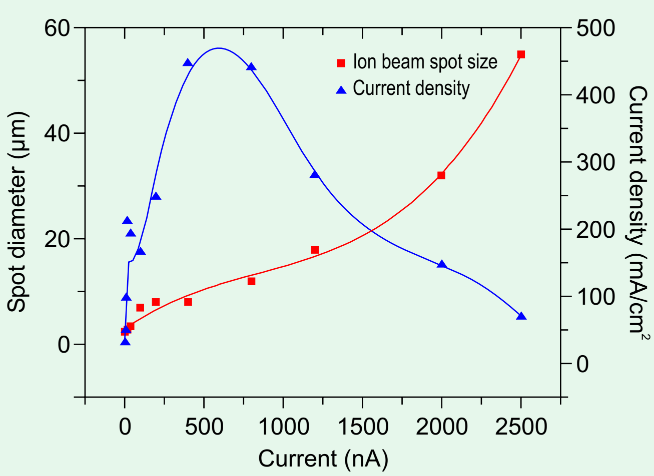


Fig 3 Performance of FIB system : Current density and ion beam spot size at various focused currents

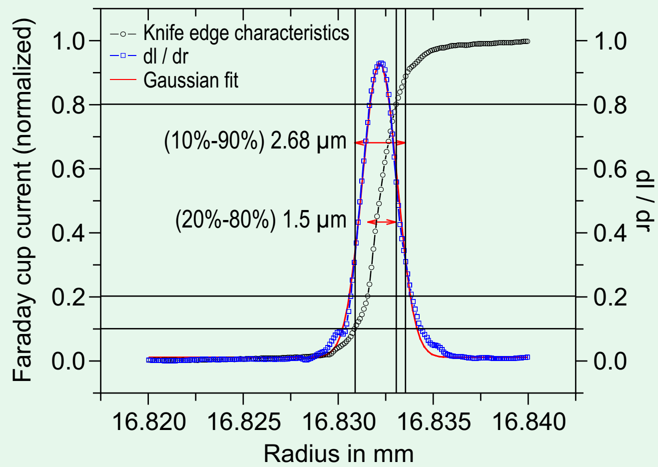


Fig 4 Ion beam profile as obtained by knife edge measurements

Low energy beam is focused onto the target at around working distance of 1 mm. Target is mounted on the 3-axis translation stage. Instead of scanning the ion beam, the sample is scanned across the beam to create desired patterns. Several micromachining experiments are carried out on silicon and copper substrates. Fig 5 shows the logo of Variable Energy Cyclotron Centre micromachined on Si wafer within 200 μm x 200 μm square area with 4 keV Argon ion beam. Fig 6 shows patterns of regular arrays of dots micromachined by Argon ion beam.

Work is in progress to micro machine insulating materials such as glass and ceramics by using electron flooding to avoid charging of the surfaces. With addition of electron beam source, this system can be used to micro machine any materials. This

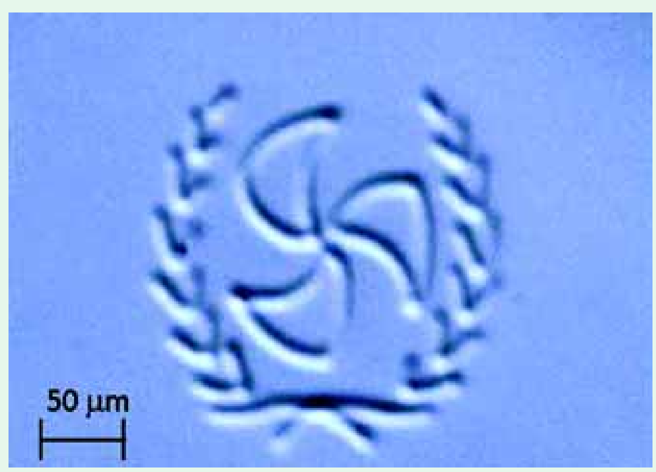


Fig 5 VECC Logo milled on Si wafer

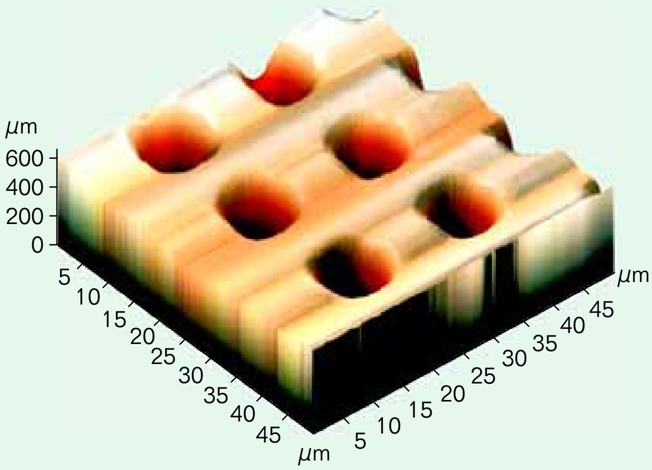


Fig 6 Array of deep holes on Si wafer

system finds potential applications as a primary ion source for Secondary Ion Mass Spectroscopy (SIMS) offering high resolution lateral as well as depth profiles. With the low energy and high current micron size heavy ion beams various devices such as Micro-coils for NMR applications, Micro-tools and Micro-channels in biomedical applications, micro-heater for gas sensors, Micro channel plates for high speed ion and electron detectors can be fabricated.

At present 5-10 micron size ion beams with current densities from 50 - 400 mA/cm^2 are available regularly for various applications. Efforts are underway to optimize the focusing column to improve the performance of plasma based FIB system to obtain the ion beams of submicron dimensions with higher current densities.

Use of Mobile Robot for Remote Radiation Mapping inside the vault of the K-130 Cyclotron at Kolkata

A mobile robot based radiation mapping system has been developed at the centre to map the distribution of the radiation dose at different regions in the Cyclotron vault as well as in the adjoining experimental caves, when the cyclotron is operational. This mapping will help estimate the accident/worst case exposure to radiation.

The mobile robot is tele-operated from a stationary computer located at the Cyclotron control room over wireless-ethernet and its position and orientation are visualized and controlled with the help of five cameras mounted at different positions in the Cyclotron vault. The mobile robot, equipped with a neutron and gamma monitor, moves around the Cyclotron vault and its adjoining areas, while the Cyclotron is delivering beam. It keeps on measuring the radiation dose and transmitting the measured value to the remote computer for visualization by the health physicist. This system is currently being used to measure the dose rate at twelve pre-decided locations in the cyclotron vault.

The mobile robot has two drive wheels and one castor for support. Steering is achieved through differential motion of the drive wheels. A supervisory microcontroller is connected to a single board computer (SBC) through serial port. The mobile robot is controlled by high level programs running on the SBC. The microcontroller receives commands from the SBC and sends command packets to two different PID controllers for the two motors, controlling the motion of the robot. Two DC

Fig 1 Mobile Robot

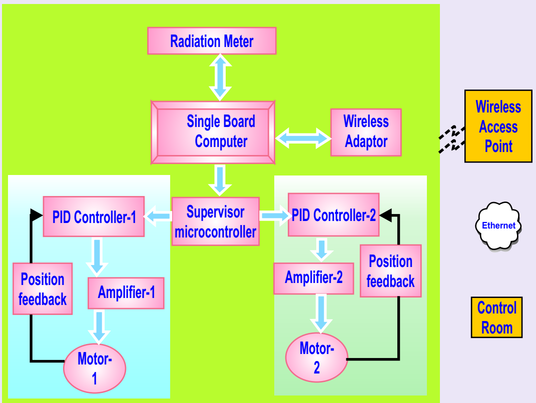


Fig 2 Block diagram of Radiation Mapping System

motors (with gearbox and encoder) drive the wheels of the robot and also send feedback about its position to the PID controller. For wireless communication with a wireless access point, the robot uses a wireless adaptor module (Fig 2).

A Gamma Neutron Survey Meter (Make: Ludlum, Model: 2363) is used for radiation monitoring. It is mounted on the mobile robot at a height of 1.2m to match with the height of the beam lines. This meter communicates with the SBC using an RS-232 serial link (Fig 2).

A 3-tier architecture is adopted for radiation mapping from the control room. The server programs for the mobile robot are implemented in the microcontroller. These processes manage the more critical and time-sensitive low-level tasks of robot control and operation, including maintaining requested motion and heading state and estimating position from odometer. The robot firmware does not, however, perform any high-level robotic tasks. Rather, it is the job of an intelligent program running on the SBC to perform these robotic control strategies and application-level tasks. An object-oriented application programming interface (API), MobileEyes, has been developed in C++. This includes many useful utilities for general robot programming and cross-platform (Linux and

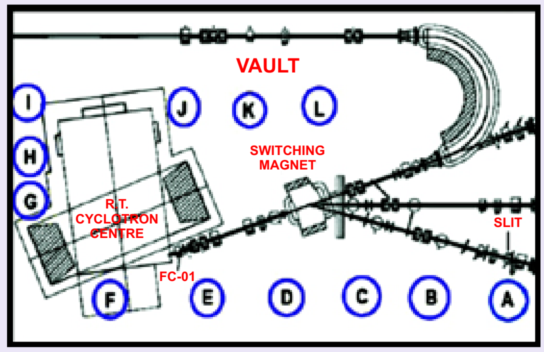


Fig 3 Different locations, marked A-L, inside the cyclotron vault where radiation measurements were taken

Windows) programming as well. This can be accessed at different levels for simply sending commands to the robot and reading status of mobile robot and its sensors.

Extensible framework for communication with remote programs over a network has been designed for application level programming. With the help these APIs, an application program, running on the remote computer located at the control room, can maneuver the robot and take it to all locations where the health physicist desires to measure the radiation dose. An application, written in Visual Basic and running on the SBC, continually acquires data from the radiation meter. To avoid network jamming, remote desktop to the SBC is done from the remote computer then MobileEyes is run from the SBC to control the movement of the robot and the Visual Basic program is run to acquire data from the radiation meter.

Fig 3 shows 12 pre-decided locations inside the vault, where radiation measurements were taken.

Table 1 shows neutron and gamma radiation at these 12 locations for 30MeV alpha beam.

This has been developed in collaboration with Health Physics Unit of BARC at Kolkata and Division of Remote Handling and Robotics (DRHR), BARC, Mumbai.

Table 1: Mapping of radiation dose at 30 MeV, Alpha

	Energy= 30 MeV, Alpha											
Positions	A	B	C	D	E	F	G	H	I	J	K	L
Neutron mrem/hr	1086	393	503	567	345	204	79	194	65	97	51	48
Gamma mrem/hr	272	71	96	119	64	30	9	93	13	18	6	8

Multicrate VME Data Acquisition System

Introduction

The multi-crate VME data acquisition system has been designed to be used in the nuclear physics experiments with large detector array. The large detector systems with more than thousand detector channels need to have a high throughput DAQ to ensure minimum possible dead time of the system.

Crate setup

The V2718 VME crate controllers from M/s CAEN and VME64x standard 6U VME crates have been used in this system. These controllers are daisy-chainable with multimode fiber optic cables and the chain is connected with the host computer via A2818 PCI interface card from M/s CAEN. One PCI card can drive upto 8 crates in a single daisy chain at 70MB/sec rate. The DAQ software can accept data from any number of crates (upto 8). Number of crates can go beyond eight by using multiple PCI cards, each with the capacity of handling eight crates.

Synchronization

Each VME module has a BUSY output, which is used to synchronize all the modules on multiple crates. A synchronizer module has been designed in-house to ensure the integrity of the data across all the crates. This single width NIM module takes the ECL busy signal and the GATE signal as input and it outputs the synchronized GATE signal only if all the modules are ready to accept data. The busy signal from the last VME module of the last crate is connected to the synchronizer for this purpose. The system was tested upto 500kHz of input rate and did not have shown any problem of synchronization loss or hanging or crashing. The software also has automatic synchronization loss detection mechanism, and automatically resets the system on the event of any synchronization loss.

Performance

The system has been tested with 5 VME modules in two crates with pulser input. The maximum parameter rate achieved is 1.2 M parameter/sec under the DAQ software, which is more than the design goal of 1Mparameter/sec. The system is ready to be used in the experiments.

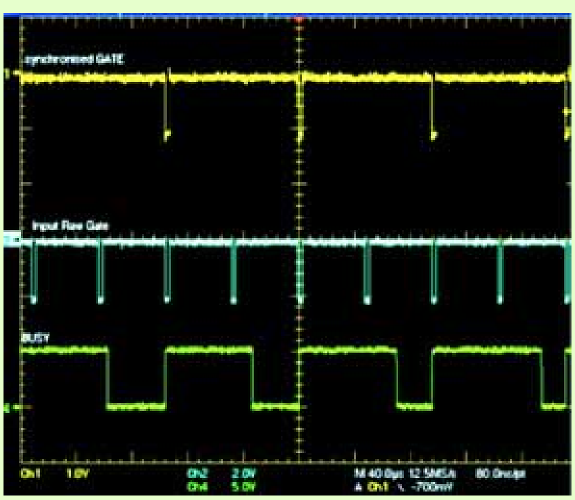


Fig 1 Yellow output synchronized GATE, blue raw input GATE, green BUSY

Fig 2 Synchronizer module

INO Prototype Calorimeter Operational at VECC

A mega-project, called the India-based neutrino observatory (INO), aimed at investigating the phenomena of neutrino oscillation will be operational in few years in the hills of Theni district, TamilNadu near Madurai. An Iron Calorimeter (ICAL) consisting of 3 modules each having 17 Kton of magnetised iron will be installed to detect the atmospheric neutrinos. As a part of this project, a prototype calorimeter consisting of 30 ton of iron has been installed at VECC. The prototype consists of 13 iron layers giving 12 gaps for inserting active detectors to be tested with cosmic rays. Four sets of coils operating at a maximum of 500 A current are used for attaining a 1 m x 1 m zone of uniform magnetic field of 1 Tesla strength. All associated systems e.g., power supply, cooling, interlock and gas distributions systems are installed and the calorimeter has been continuously taking data since several months with 6 resistive plate chambers (RPC), including two bakelite RPCs developed at VECC. Dr. Srikumar Banerjee, Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy, Govt of India visited the laboratory on 19th July, 2010.

SOCIETAL APPLICATIONS

Design of a low cost high resolution Gamma Imaging Device

The Computer and Informatics Group of VECC has taken up a project towards societal application to build a low cost high resolution gamma imaging system. The objective is to aid the diagnosis for early detection of breast cancer. The functional image of breast is advantageous in diagnosis as the complex anatomy and calcifications problem of breast do not arise during imaging. Hence, very accurate detection of small lesion enables the early detection of breast cancer.

The common and crucial technical issues are in the design of pixelized detector, accurate triggering circuit and readout system. This ensures accurate acquisition of images by detecting the desired energy for thousands of pixels with millimetric spatial resolution. The effect of dead spaces between pixels and its minimization is also an important part of designing such detectors. The position sensitive photomultiplier tube (PSPMT), avalanche photo diode (APD) array and charged coupled device (CCD) attached with pixelized scintillators are the initial choices for the detector design.

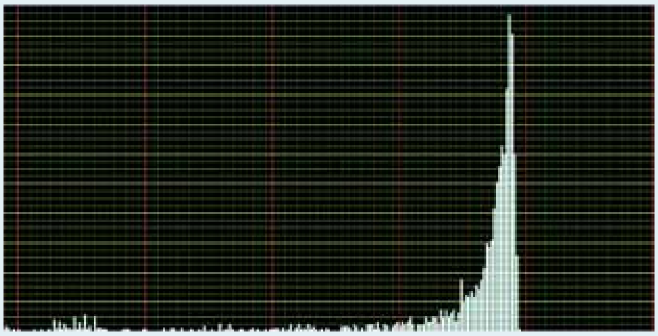


Fig 1 Spectroscopy of single channel

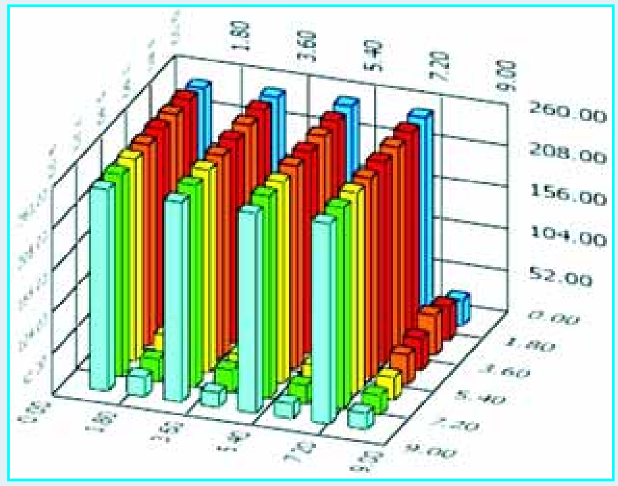


Fig 2 Odd channel ADC count from uniform source

To evaluate the functionality of the detectors and electronic readout system, the output of a single channel photomultiplier tube coupled with CsI(Tl) scintillator has been fed to a 64 channel front-end ASIC chip. The complete readout system consists of a trigger circuitry, an ALTERA FPGA and a 12 bit ADC. The whole set up for the acquisition system has been used for multi pixel data acquisition with Technitium-99m.

The spectroscopy has been carried out to calibrate the imaging system as shown in Fig1. The odd channel ADC count in X-Y matrix as shown in Fig 2 has been obtained by passing signals in odd channel of the front-end ASIC while even channels remained not connected.

The complete setup for the acquisition of 256 multi anode photo multiplier tube and dynode trigger circuitry is designed and the fabrication of PCBs for preprocessing and data acquisition is outsourced. The acquired image from a gamma imaging system suffers from low contrast as a result of some physical phenomena like scatter, attenuation, septal penetration and partial volume effect. In all these factors, the problem of photon scattering largely degrades the image quality. The different scatter correction algorithms have been assessed and the development of a deconvolution based scatter correction algorithm is initiated with the images from the 256 pixels gamma camera.

COLLABORATIONS

VECC-FAIR collaboration: an update

FAIR-GmbH has been formed on 4th October, 2010 at Darmstadt, Germany in presence of the representatives from 9 founder countries including India. Dr. T. Ramasami, Secretary, Department of Science and Technology represented India in the signing ceremoney. VECC is expected to play a major role in terms of building accelerator components and detectors in major experimental programmes at FAIR.

EVENTS

ICPAQGP-2010 serves the Big Bang Soup at Goa

Variable Energy Cyclotron Centre, Kolkata hosted the sixth International Conference on Physics and Astrophysics of Quark Gluon Plasma (ICPAQGP-2010) at the National Institute of Oceanography (NIO), Goa, India during 6-10 December 2010. The timing of the Conference was ideal as it was at the end of the three-week spell of heavy-ion collisions at the Large Hadron Collider (LHC). All the three major experiments (ALICE, CMS and ATLAS) presented the very first results from the just completed heavy-ion run. The Relativistic Heavy Ion Collider (RHIC) at BNL, a dedicated facility for the search and study of Quark Gluon Plasma, completed first stage of running for the search of QCD Critical Point. Very first results from these runs were presented, for the first time.

The warm Goan weather at this time of the year provided excellent ambience for scientists and young researchers to discuss and debate the new results and their physics and astrophysics implications. The Conference attracted more than 250 participants including 70 from abroad. The most noticeable feature of the Conference was the participation of a large number of energetic and vibrant Ph.D. students who made the discussions lively. Thanks to the generous funding by several agencies, financial support could be extended to most of the young researchers.

One of the major events this time was the inclusion of a Student Day on December 5th, prior to the start of the main Conference. It consisted of pedagogical lectures delivered by some of the eminent scientists in the field from various parts of the world. More than one hundred scholars and young researchers from various institutions and universities attended the Student Day. The speakers of the student day discussed physics of quark gluon plasma, experimental techniques and physics of standard model and beyond.

Dr. Rakesh K. Bhandari, Director, VECC inaugurated the conference in the presence of Prof. Bikash Sinha, Homi Bhabha Professor, Department of Atomic Energy, Dr. Tapan Nayak and Dr. Premomoy Ghosh, the Chairman and the Convener, respectively, of the organizing committee. Prof. Sinha delivered the keynote address. The scientific sessions started with an overview talk by Joseph Kapusta, University of Minnesota and included experimental highlights from SPS, GSI, RHIC and LHC, lattice calculations, search for QCD critical point, electromagnetic probes, quarkonia, heavy flavours, energy loss, jets, AdS/CFT

correspondence, hydrodynamic and viscous-hydro calculations, diffractive physics, reports from upcoming facilities, such as FAIR, eRHIC, J-PARC and NICA, as well as talks on quantum gravity and neutron stars. In addition, the program included large number of theoretical presentations on various QCD models, equation of state and connection to astrophysics. The Conference included an evening lecture by Satish Shetye, Director NIO on the Indian monsoon. Nu Xu of LBNL Berkeley and Larry McLerran of BNL made the experimental and theoretical summary presentations respectively, with an outlook to the future.

Concluding remarks by Bikash Sinha took the participants back to the first Conference of the series, held in 1988 at Mumbai and outlined the important role of the ICPAQGP series has played in building a vibrant community of scientists engaged in this frontline area of physics. The other Conferences in this series took place in Kolkata (1993), Jaipur (1997), Jaipur(2001) and Kolkata (2005). We look forward to the next one, which will be held in the year 2013 as the silver jubilee anniversary of the ICPAQGP series.

The proceedings of the ICPAQGP-2010 will be published by Nuclear Physics A, Elsevier Publication.

The conference was organized with financial support from BRNS, DAE; VECC, Kolkata, IIT-Bombay, Mumbai, Bose Institute, Kolkata; SINP, Kolkata, IOP, Bhubaneswar, TIFR, Mumbai. The National Institute of Oceanography, Goa extended generous support in holding the conference in the institute's auditorium.

Theme Meeting on Nucleus-Nucleus collisions around Fermi Energies(NNCAFE-2010) : Sponsored by Board of Research in Nuclear Sciences, Department of Atomic Energy, Government of India

The first Theme Meeting on Nucleus-Nucleus collisions around Fermi energies (NNCAFE-2010), Sponsored by Board of Research in Nuclear Sciences, Department of Atomic Energy, Government of India, took place on December 16-17, 2010 at the Variable Energy Cyclotron Centre, Kolkata and was organized with the aim to discuss the relevant physics issues which can be pursued using beam from Superconducting Cyclotron. The superconducting cyclotron (SCC), at VECC, is expected to deliver soon a large variety of particle ion beams over a wide range of energies and open up a new frontier in intermediate energy nuclear physics research in India. A comprehensive utilization programme is presently being implemented and several large detector facilities are being developed as part of the superconducting cyclotron utilization programme (SUCCUP).

The physics topics which were discussed are multi fragmention, isospin physics, fission dynamics, multiparticle correlation studies and γ-ray spectroscopic studies, which can be pursued using the facilities being developed for superconducting cyclotron utilization project. There were around 27 invited talks/seminars. Renowned national and international experts in the field had been invited to deliver talks on these topics. Moreover, delegates (research scientists, university faculties) from various National laboratories and Indian universities had been invited to deliver talks and to take part in the discussions with a view to chalk out the initial phase of SCC utilization program. Students from different universities and national laboratories had participated in this meeting. The total participants were 120.

The meeting was inaugurated by Prof. R.K. Bhandari, Director, VECC , who welcomed the participants and presented a brief review of the activities of the centre. Prof. D.K. Srivastava, Chairman, organizing committee, explained the theme of the meeting. Dr. C. Mallik, VECC, gave an overview of the present status of the both room temperature as well as the superconducting cyclotron. Prof. S. Kailas, Head, Physics Group, B.A.R.C, presented the recent highlights of nuclear physics research mostly done using facilities in India. Prof. S. Bhattacharya, VECC, then gave an overview of the planned nuclear physics activities using beam from super conducting cyclotron with special emphasis to the present status of development of different experimental facilities. The inaugural session ended with vote of thanks presented by Dr. C. Bhattacharya, Convenor, of the meeting .

Knowledge of nuclear matter equation of state (EOS) over a broad range of varying density, and isospin is of crucial importance in understanding energetic heavy-ion collisions, properties of exotic nuclei, structure and composition of neutron stars, and core collapse supernovae. While there are large number of studies available on EoS around the saturation density, attention to EoS for very dilute densities is a rather recent event. Prof. M.B. Tsang, NSCL, MSU,USA, and Prof. Enrico de Fillipo, INFN, Catania, Italy, gave detailed pictures of present status of isospin physics studies using multi detector array. Prof. G. Verde, INFN, Catania, Italy, discussed an elaborative in his talk, the present status and perspectives of correlation function studies with special emphasis on the role of multi detector array in such studies. Prof. S. Pal, TIFR, described in details way the properties of hot and asymmetric nuclear systems formed in intermediate energy heavy-ion collisions. Prof. B. John, BARC, presented in his talk, some of the recent experimental results concerning the EOS observables obtained using the K500 Superconducting cyclotron at Texas A&M University.

In the low energy domain, fission still remains an interesting area of study. Various aspects of Langevin dynamics of nuclear fission has been discussed in great details by Prof. S. Pal, VECC. Recently, there is lot of interest to study the mechanism of formation of new super heavy elements (SHE). Major hindrance in the formation of super heavy elements is due to quasi-fission process. Dr. T. Ghosh , VECC, and Prof. B. R. Behera, Panjab Univ., gave comprehensive pictures of present status of the quasi-fission studies and super heavy elements. Giant dipole resonance (GDR) studies of nuclei as a function of both temperature (T) and spin (I) have been an interesting and important area of research in nuclear structure physics. Prof. S. R. Banerjee, VECC and Prof. P. Arumugam, IIT, Roorkee, gave extensive overviews and discussed about possible experiments on GDR studies which can be done using LAMDA detector array developed at VECC.

One major thrust area in recent years, is the study of structure of neutron rich nuclei. Deep-inelastic multi nucleon transfer reactions are known to be powerful tools to study the yrast structure of neutron rich nuclei. Prof. P. Chowdhury, Univ. of Lowell, USA, gave an overview and recent advances in spectroscopy of heaviest nuclei accessible via. heavy ion reaction using large detector arrays. Open questions and experimental challenges in pushing the limits of spectroscopy at the heavy frontier have been discussed with special emphasis on how excitation in heavy deformed nuclei can help streamline models which predict the magic spherical gap and describe the stability of super heavy nuclei. Dr. S. Bhattacharyya, VECC, Prof. A. Goswami, SINP and Dr. S.S. Ghugre, UGC-DAE-CSR, presented the status of these studies and possible experiments using segmented GAMMA detectors array. Prof. R. K. Bhowmik, IUAC, New Delhi, also discussed the necessity of some spectrometer for studying the spectroscopy of neutron-rich nuclei. Prof. S. K. Mandal, Delhi Univ., discussed the several aspects of nuclear structure and dynamics at extreme conditions of angular momentum, spin and isospin, which are still unexplored and can be studied using beam from SCC.

One session was devoted to discuss about detectors and related instrumentation techniques with special emphasis on the facility development programme taken up at VECC for SCC utilization. Young researchers of VECC have presented the status of various in house experimental facilities viz. Scattering Chamber (S. Kundu), Large area Modular detector Array (LAMDA) (S. Mukhopadhyay), 4π - charged particle detector array (CPDA) (T. K. Rana), Neutron multiplicity detector and TOF detector array (K. Banerjee), Ion trap (Dr. P. Das) and Data acquisition system (P. Dhara). Dr. G. Politi, INFN, Catania, Italy, described in details new pulse shape analysis technique for identifying charged particles which stopped in single Si detector, which is likely to improve the performance significantly.

Apart from these discussions, an evening lecture was delivered by Prof. B. Sinha, DAE Homi Bhabha Professor, on contemporary topic: "Sustainable clean energy resource a new paradigm for saving the earth".

To sum up, the meeting was very successful in motivating the user's community to shape up their experimental plans through close interaction with various user groups. It was also very beneficial to students working in these fields.

AWARDS

Homi Bhabha Science and Technology Award

Dr. Subhasis Chattopadhyay, Experimental High Energy Physics Group and Applications (EHEPA), VECC, received the prestigious Homi Bhabha Science and Technology Award for the year 2010 for his contributions in the field of Experimental high energy physics.

DAE-SRC Outstanding Research Investigator Award

Dr. B. Mohanty of EHEPA group, VECC has been designated as "DAE-SRC Outstanding Research Investigator" in 2010.

Scientific & Technical Excellence Award, 2009

Mr. Sushanta Pal, EHEPA group, VECC has been conferred the Scientific and Technical Excellence Award for the year 2009 in recognition of his outstanding contribution in field of Electronics and Data Acquisition Systems developed for the Photon Multiplicity Detectors(PMD) in STAR and ALICE experiment.

Young Technologist Award 2009

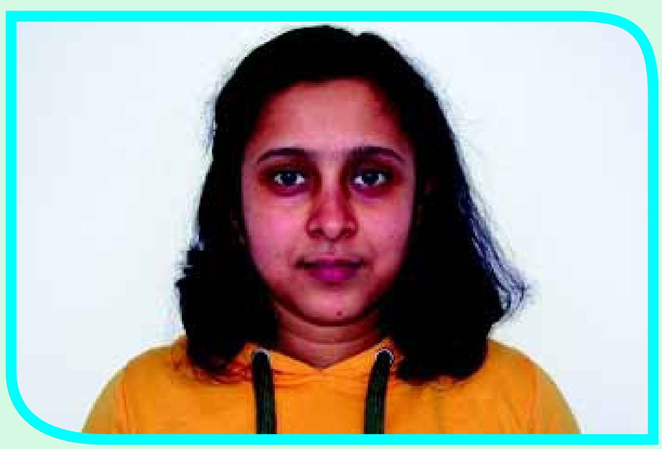
Shri Sumantra Bhattacharya, Accelerator Technology Development (Mechanical) Division, Accelerator Physics Group has been conferred the "Young Technologist Award 2009" in recognition of his outstanding contribution in the field of Accelerator Technology.

Meritorious Service Award 2008

Shri Ramen Das, Accelerator Technology Development (Mechanical) Division, Accelerator Physics Group has been conferred the "Meritorious Service Award 2008" in recognition of his outstanding contribution in the field of Cyclotron Operation and Maintenance.

C V K Baba prize

The best thesis award, the C V K Baba prize of Indian Physics Association was conferred on Ms Rupa Chatterjee, Senior Research Fellow of Physics Group in the DAE Symposium on Nuclear Physics held at BITS, Pilani during December 20-24, 2010 for her thesis entitled "Consequences of Elliptic Flow in Relativistic Heavy Ion Collisions". Rupa did her Ph D under the supervision of Dr. Dinesh Kumar Srivastava, Head, Physics Group.



Poster Award in DAE Safety & Occupational Health Professionals Meet

Shri Manik Chandra Manna of Accelerator Technology Group, VECC was awarded the 3rd prize in the poster session for his poster titled "Safe Procedure for Identification and Disposal of Unused Chemicals" presented in the 27th DAE Safety & Occupational Health Professionals Meet 2010 organized by AERB and NFC and held at NFC, Hyderabad during Nov 25th to 27th, 2010 with the theme "Chemical Safety, Waste Management & Industrial Toxicology".

HONOURS

Dr. Tapan K. Nayak, EHEPA group, VECC, has been elected to the Management Board of ALICE Collaboration for a period of two years beginning Jan 2011. He was elected by more than two-third majority vote in the election held during ALICE Collaboration Board meeting in Nov 2010. The Management Board of the ALICE Collaboration, which acts like a cabinet under the Chair of Spokesperson, has four elected members in addition to various ex-officio members. Tapan is the first non-European to be elected to the MB.

VECC NEWSLETTER COMMITTEE

Feedbacks may please be sent to

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ERRATA

The correct caption of the photograph in pg 8 of VECC Newsletter September 2010 issue (VECC-NL-1209) will be Heavy Ion RFQ Development.

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