3. RESEARCH SUPPORT FACILITIES

3.1 HIGH VACUUM LABORATORY

A. Kothari, P. Barua and D.K. Avasthi

A UHV system with RGA facility is being designed and fabricated for testing new gauges and for testing reconditioned Ion pumps. This could further be used in the analysis of gas purity and outgassing studies of different materials. Regular support was provided to users for various vacuum related problems and leak testing. Centralized purchasing of essential vacuum components from local and foreign companies was carried out to maintain essential components in stock. Contaminated penning gauges are cleaned and tested regularly to maintain stock of gauges in working condition, for emergency replacement.

Vacuum related support was provided to Material Science, Bio Science and LIBR experimental facility. In material Science high vacuum chamber a leak was detected from the diffusion pump side. After dismantling and cleaning the entire pumping system the leak was found in LN_2 trap. So the diffusion pumping system was isolated and a turbo pumping system was installed at cryo pump port.

3.1.1 Installation Activities

There were several activities related to installation at different places. The activity of AMS beamline and Ion source test bench setup was in conjunction with other groups and vacuum group was actively involved through out the installation and vacuum establishment activity.

AMS Beamline Installation: LIBR beamline was completely dismantled to install AMS components into the line. Wien Filter magnet and a BPM just before it were installed. Additional turbo based pumping system was also installed to take care of the outgassing load from Wien filter. The BPM and wien filter were correctly aligned with the beam axis. Later on the quadrapole chamber was also put in the beamline. The whole line was leak checked after installation. The alignment of the experimental chamber was also corrected.

Ion Source Test Bench Installation: There was extensive involvement of the vacuum group in the installation of Ion source test bench in the Ion Source room. It would be used to develop an study new beams and to conduct experiments at very low energy ~50 keV. All the essential components like high voltage deck, Bending magnet, BPM, Faraday cup, Einzel lens, Pneumatic gate valve, Accelerating tube, Steerer, Double slit, pumping cross, Ion pump, turbo pump, have been installed. First the magnet was placed at appropriate position and then the beam axis line was marked on the floor perpendicular to the magnet ports. Theodolite was set along the line at magnet port height and then all the components were installed with proper stands and brackets and aligned with good accuracy. Finally the leak testing was done and good vacuum was obtained.

Bio Science Beamline Alignment : The alignment of the bio-science line was disturbed during INGA experimental setup. Whole beamline was vented and realigned with existing references.

3.1.2 Installation of Phase - II Beamlines

A. Kothari, P. Barua and A. Mandal

Phase II Beamline Installation : Zero degree beamline for phase - II experimental facility lines was installed, extending from LINAC - I module upto Rebuncher. The reference line and height for the installation was taken from the quadrapole, just before Linac-I, and the point on the ground just before Rebuncher, marked during previous installation. The quadrapoles and other components were installed and properly aligned. The points have been transferred to an intermediate joint and quadrapole's flange for further reference. LINAC-I module was also adjusted for alignment. Alignment of the Rebuncher was also done. Switching magnet for phase - II was placed after Rebuncher and aligned with the existing. The whole line was leak tested for possible leaks and were rectified.

In Phase II initially the installation of four beamlines is planned. Among the four the installation of material science beamline is completed after switching magnet at +10 degrees. Beamline components i.e. ion pump, getter pump, quadrapole, vacuum gauge, beamline valves etc. were installed and aligned. Material science chamber was also installed and aligned with the beamline.

3.1.3 Pelletron Support

There is regular involvement with the pelletron group in maintenance activity, scheduled and emergency, requiring vacuum operations, maintenance of vacuum pumps and installation of critical components. Some of the major work are outlined below.

3 Regular foil stripper changing activity.

4 Through leak rectification in NEC valve in high energy area.

5 Replacement of terminal Ion pump.

6 Overhauling of Getter pump 03-1 and cartridge replacement.

7 Pendulum valve 03 area replacement : The Pendulum valve at tank bottom had developed some problem and it had stopped functioning. It was replaced with a repaired pendulum valve in a short span of time. The area at the valve site is so con-

gested that we had to dismantle the Ion pump, Getter Pump, RGA, Ion Gauge, Pumping cross and other installed components.

8 BLV 03-2, fast closing valve seat changed to rectify through leak.

9 Reorganizing installation of BPM, FC and Valve in 03 area in proper sequence.

3.1.4 Auto Slit assembly installation in GPSC and its Linear motion Motorization

A. Kothari, Rewa Ram and P. Barua

An auto slit assembly with provision of slit motion was modified to have a motorized linear motion and readback of its position for proper usage. A motor driven gear mechanism with proper readback facility to read the proper position of slit was fabricated to limit the motion of slits. It was then installed in the GPSC and proper calibration of the movement was done so as to facilitate its remote operation.

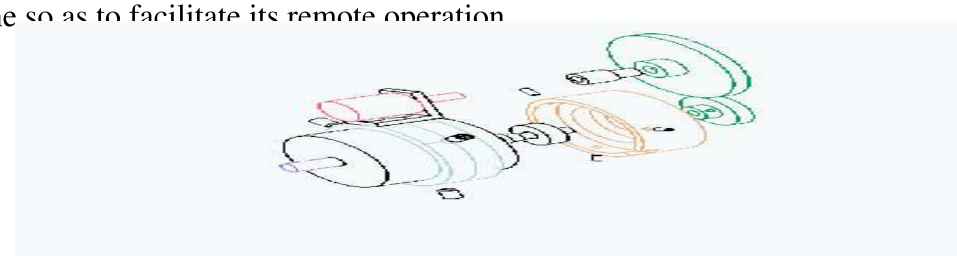
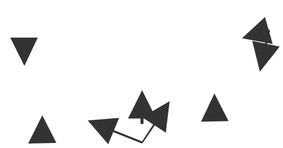


Fig. 1 : Exploded View of the Assembly showing various



3.1.5 Beam Line Maintenance

Beamline valve of HIRA (BLV L3-2) bellow had a leak and it was replaced. In material science beamline (BLV L5-2) valve bellow had a through leak in the range of 10^{-4} Torr. It was replaced with a new bellow. Complete overhauling of the material science line Getter pump line was done and cartridge replaced. Alignment of HIRA beamline was checked and quadrupole and chamber inlet were found to be 15 mm down from center. Overall maintenance of the beamlines was taken care of and minor maintenance was done where ever required.

3.2 MAINTENANCE OF MAGNETS AND POWER SUPPLIES

S.K.Suman, Rajesh Kumar, A.J.Malayadri and A.Mandal

Routine maintenance of all magnets and their power supplies have been done twice in the last year to keep the up-time of Beam Transport System maximum. Following tasks were carried out in the maintenance:

10 Stability measurement and rectification of bending magnet power supplies

11 Testing and calibration of all safety interlocks and read backs

12 Output ripple monitoring of all power supplies and minimising it by repairing /replacing different capacitor filters

13 Changing faulty power transistors

14 Dust cleaning of electronic cards of all magnet power supplies

15 Changing corroded heat sinks of power supplies

16 Checking of power connections of all magnets and their power supplies

17 Temperature monitoring of all magnets at full load current to locate the coils which were heating up more than the specified temperature and cleaning them with high pressure water or sulphamic acid

18 Changing damaged hose pipes

19 Checking input and output power connections for loose contacts

20 A lower failure rate was observed for the magnets and their power supplies during last year. Some major maintenance jobs done during the last year are described later

21 A complete scan of magnetic field of Analyser magnet has been done to find out the cause of instability at 430 mT. The problem was located in register board. One IC (chip) was malfunctioning in this board. Due to this digital data at the input of DAC was unstable and hence instability was coming

22 During operation, a few cards which failed in power supplies time to time were replaced by spare ones to minimise the down time and later on cards were repaired

23 Repaired corroded transistor bank heatsink of bending magnet

24 Installed and tested a new magnet power supply for PH-I switching magnet

25 Mat. Sc. quadrupole magnet's coil were cleaned by sulphuric acid. It was found that water flow rate became very low as compared to specified rate. This happened due to deposition of dust particles inside the coil's cooling path. So magnet was heating up more for higher magnetic field

3.3 DETECTOR LABORATORY

Akhil Jhingan, T.Varughese and P. Sugathan

The detector laboratory provided support to many user experiments for setting up gas detectors and silicon detectors. Some new detectors were developed for various nuclear physics experiments. Our group is also involved in developing cost effective detectors based on solar cells and scintillators. Support and training were provided to various experimental groups, research students and trainee scientists.

3.3.1 Large Area Multi Wire Proportional Counter for HIRA Focal Plane*

A large area position sensitive multi wire proportional counter (MWPC) has been fabricated for HIRA focal plane setup. The detector has an active area of 6” × 2” and is based on 5 wire electrode configuration. X and Y position signals are readout using standard delay line readout technique. Wires are separated by 1.27 mm in all electrodes. For position electrodes, two wires each are shorted and connected to one tap of the commercially available Rhombus (TZB-12-5) delay line chips. Each tap has a delay of 2ns. There are a total of 120 wires in X position frame and 40 wires in Y frame giving an end to end delay of 120 ns and 40 ns in the respective electrodes. The frames are housed inside a circular Aluminium chamber machined from a single aluminium block. The body of the detector can be mounted directly on the new HIRA focal plane chamber without any adapter flange. The detector was tested with ^{241}Am alpha source with pressures varying between 1 Torr and 4 torr of isobutane gas.

3.3.2 Large Area Multi Wire Proportional Counter for GPSC*

Another large are MWPC was fabricated for GPSC related nuclear physics experiments. It has an active area of 8” × 4” and has a 5 electrode geometry. Design is similar to that of HIRA focal plane MWPC except that the end to end delay is 160ns and 80ns respectively for X and Y position planes. The detector was tested with ^{241}Am alpha source with pressures varying from 1 torr to 4 torr of isobutane gas.

*****_The detector housing was machined by Mr. R. Ahuja of NSC workshop._

3.4 TARGET DEVELOPMENT LABORATORY

D. Kabiraj, Abhilash S. R and D. K. Avasthi.

Target Development Laboratory at NSC provides facilities to the users for the preparation of targets used for experiments with NSC Pelletron. Several targets have been prepared in the last year for studies in Nuclear Physics, Atomic Physics, Materials Science and Bio Science. The following gives an account of the attempts made using various techniques for the preparation of targets. There were 96 and 50 evaporations attempted in HV and UHV evaporator respectively. There were 39 foils prepared using rolling technique. In addition to this, 600 carbon stripper foils of less than 5 $\mu g/cm^2$ thick were also prepared for NSC Pelletron. The target preparation facility was used by 73 different users during this year.

A new evaporator has been installed which includes a wide beam ion gun, resistive heating arrangement and a quartz crystal thickness monitor. A turbo molecular pump is used for pumping and the base pressure achieved is ~10^{-7} mbar. There is substrate cooling arrangement that cools down to 100 deg K using liquid nitrogen.

The ion gun has been installed primarily to sputter clean the native oxide layer on the Si substrates, prior to thin film deposition, to achieve a clean metal-Si interface. The ion gun is mounted in such a way that the ion beam strikes the substrate at an angle of 45^o from a distance of ~100 mm. The typical beam parameters (as per the specifications given by the manufacturer), using plasma current of 40 mA are: (i) Area: 60 × 30mm, (ii) Current density: 30 $\mu A/cm^2$, (iii) Energy: 0.8 kV-2.3 kV. The construction of the gun ensures that the beam consists of essentially atomic neutrals. The advantage is that, any charge formed at the surface of the dielectric will not deflect the incident beam due to the neutrality of the atoms produced by the source. Any charge effect on the surface will be due to the secondary emission of electrons being lost to the other parts of the system. Dielectric and insulating materials can be cleaned or etched with comparable results to that of conductors. The plasma chamber of the source and the electrodes are made of carbon and coupled with the cold cathode operation of this construction, allows the source to be used with gases that are not necessarily inert. Initial testing showed satisfactory results of sputter cleaning of thermally grown oxide layer on Si, using Ar gas at a background pressure of ~$1x10^{-3}$ mbar.

3.5 ELECTRONICS & RF LAB

Ajithkumar B.P., A. Sarkar, B.K. Sahu, K. Singh, S. Venkataramanan, R. Shanthi, A. Pandey, A. Gupta, K. Rani, S.J. Venkatesha, M. Jain, R.N. Dutt, E. T. Subramanian and V. V. V. Satyanarayan

3.5.1 Radiation Detection and Pulse Processing System for University Laboratories

We have developed a low cost system for doing nuclear physics experiments at the universities. A charge sensitive pre-amplifier, a shaping amplifier and an ADC are wired on a single board with an interface to the Printer port of the PC. The pre-amplifier design is transistor based and uses only locally available components. The shaping amplifier has one differentiating and two integrating stages with jumper selectable time constant. The shaper output is fed to a peak sensing ADC implemented using the 16 bit AD676 ADC chip from Analog Devices Inc. The circuit also uses several op-amps and switches from analog devices. The shaper output is connected to a threshold detector that initiates the digitization of an incoming pulse signal when it crosses the preset level. The electronics can be used with any available type of detector with proper bias supply. We have used solar cells to detect alpha particles with an energy resolution of seven per cent.

The software is written in C language under the Linux operating system and uses X-window graphics. It reads the ADC and builds the histogram. Ten such units have been made for distributing to the universities.

3.5.2 General Purpose Controller with embedded computer

A general purpose control box with an embedded computer has been developed. It has 64 ADC channels, 28 DAC channels, 32 relay controls and 32 input level sensors. It can replace the expensive CAMAC and VME systems for many applications. The entire system is packaged in a 5" height rack mountable module, with built in DC power supply. The on board single board computer can either operate from the local Flash disk or it can boot from a remote Linux Server. Since the only control link required is the ethernet cable, the system can be used on high voltage platforms with fiber optic ethernet link.

3.5.3 A List Processing CAMAC Crate Controller

A List Processing Crate controller combines the functions of the Crate Controller and List processor. The design is based on FPGAs and has an embedded computer on board. The onboard computer is capable of booting from a remote Linux Server to eliminate the local disks. The measured data transfer rate of this controller is more than one Megabytes per second and it will be used in the high speed data acquisition system.

3.5.4 Liquid Nitrogen Filling system for INGA

The Germanium detectors require periodic filling of Liquid Nitrogen to keep the temperature very low and automated filling systems are being used for this purpose. A 32 channel LN2 filling controller has been developed and tested. It is a 5" high rack mountable unit with built-in computer. On power up the on board computer loads Linux operating system from a remote server and starts running the server program to manage control the valves and temperature sensors.

3.5.5 CAMAC Interface for LINAC Resonator Controller

The LINAC resonator controller module has several analog and digital input/output signals that need to be interfaced to a computer. The input signals are mainly the loop phase shift, reference phase shift, amplitude and output gain controls. There are read back signals for phase error, amplitude error, offset frequency and RF field level inside the cavity. In total there are eight analog inputs and four analog read back signals in addition to the status control and status reads. One method of interfacing these signals to CAMAC is to use ADC, DAC, Output Register and Input Gate modules and make a switch yard to route the signals to appropriate modules. This method allows one to use the standard modules but requires a lot of cabling and a switch yard.

Having a dedicated CAMAC module to take care of one resonator controller module eliminates the need of the switch yard and results in a much more modular system with a single interconnecting cable between the controller and the CAMAC. The CAMAC module developed has eight analog outputs, four analog inputs and several digital input and output signals. The resonator phase control is done by setting the sine and cosine components through two separate inputs. The module also has additional status read back and control for the RF amplifier. The new module has been integrated into the existing control system[2] and support for phase control has been added to the software.

3.5.6 PCI Interface for 4-channels Shaft Encoder

Our Accelerator Control Systems uses shaft encoder knobs as analog input devices. The knobs function as control knobs that can be assigned to any device using appropriate hardware and software. We had TTL circuits to interface the knobs to the PC using ISA bus that is now almost obsolete. The circuit is now implemented using FPGAs and interfaced to the PC using PCI interface.

A shaft encoder when rotated gives two pulse trains whose frequency depends on the speed of rotation and the relative phase on direction. These pulses can be used to modify the value of a counter and that in turn changes the value of some parameter under the control of software. The four channels of sixteen bit counters are implemented using the Xilinx XC4010 FPGA chip. The counter circuits are located on the PCI card and are interfaced to PCI bus using the AMCC S5933 chip. The AMCC5933 takes care of the interfacing details. Data transfers between PCI bus and the Add-On logic using the Pass-Thru interface are implemented with a handshaking scheme. One CPLD has been used to provide handshaking signals. The card accepts TTL clock pulses generated by shaft encoders through a 40-pin FRC connector. It also reads the status of some switches used by the software to control the functioning of the shaft encoder.

The control software runs under the Linux operating system and the communication to the shaft encoder circuit is done by the device driver. It implements the function calls to read and write the counters through the PCI bus. The PCI based shaft encoder was essential for upgrading the control system computer since the new PCs do not have the ISA bus. The new circuit is being used for running the accelerator for the past several months.

3.5.7 CAMAC Crate Controller running GNU/Linux

The Data Acquisition and Accelerator Control Systems at Nuclear Science Centre employ the CAMAC interface standard. The distributed control system currently running the Pelletron accelerator has four CAMAC crates each interfaced to a Linux PC connected over a network and the number of Crates will increase with the addition of LINAC control. In order to avoid the installation and maintenance of a large number of PCs connected to the Crate Controllers, a new controller with built-in computer has been designed.

A commercially available single board computer, SBC, from Advantech is integrated into the controller. The PC104 connector provides the interface between the SBC and other components of the board. The board is placed in such a way that the ethernet port is accessible from the front side. The controller circuits communicates to the computer through eight bytes in the PC I/O address space. For control system applications we need to run Linux on each Crate Controller. The BIOS of the SBC has been modified to include the "etherboot" program for the on board RTL8139 ethernet interface. On powering the operating system is fetched from a central computer running the Linux Terminal Server software. The Server program and Database files are also loaded from the server. The new Controller has been tested and implemented on the Accelerator control system. It is more reliable than conventional PCs since there is no moving parts inside. The network booting makes the maintenance easy, there is no need to upgrade any software at the controller.

3.5.8 Electronics Activity related to Indian National Gamma Array

After successful testing of two prototype INGA Electronics modules with HIRA+INGA setup at NSC, we have successfully completed the task of mass production of 12 Nos. modules. The minor modification in Anti-Coincidence Logic card and Fast NIM output of individual HPGe segment Timing outputs are provided.

Meanwhile the technical staff from SINP, Kolkata are being trained in duplicating two such modules. The completed modules are given to SINP, Kolkata and TIFR, Mumbai for evaluation purposes.

3.5.9 Modification of Shaper card for INGA

In order to use the Shaper card developed for INGA with other spectroscopy applications requiring various different shaping time constants, we have developed shaper cards having 0.5µS, 1µS, 2µS, 6µS timing constants. The critical component values were obtained by simulating the circuit in PSPICE electronics CAD software.

3.5.10 Development of Charge Sensitive Preamplifier (NSCPAC1)

A general purpose charge sensitive preamplifier in high density form for use with silicon surface barrier detector has been developed and implemented successfully at NSC. The low noise, wide bandwidth amplifier with programmable open loop gain is implemented with state of the art SMT components. This preamplifier provides fast timing output having rise time better than 2nS (slope 0.5nS/pF) and energy resolution of better than 4keV (slope 20eV/pF).

3.5.11 Technology transfer of RF Generator

The technology earlier developed for a 13.56MHz, rugged 500watts Solid state RF generator for sputtering applications along with Matching network has been transferred to M/s. Vacuum Equipment Co., New Delhi on exclusive basis apart from M/s Hind High Vacuum Company Ltd., Bangalore. In this regard, technical staff from M/s Vacuum Equipment Co., New Delhi have been trained in assembling a 13.56Mhz, 500Watts RF generator and a Matching Network. Meanwhile, we have been informed by M/s Hind High Vacuum Company Ltd. Bangalore that, the RF generator and Matching network manufactured with technology transferred from NSC have been supplied to various institutions within country and abroad. The technology was developed with DST funding during 1993-1996.

3.5.12 A modular VHF Power amplifier

The resonator cavities of the LINAC accelerator at Nuclear Science centre require around 400 Watts of power at 97 MHz to stabilize the RF phase and amplitude inside. The resonator accepts only 4 to 6 watts of power and the rest is reflected back. Our earlier design used a circulator and dummy load to protect the amplifier from the reflected power. Being a narrow band device, circulator does not protect the amplifier in case it breaks into oscillations at other frequencies. The bandwidth of the amplifier also is limited by the circulator. A new amplifier that can withstand full reflected power without using a circulator has been developed and tested now.

The total power is obtained by combining several identical units connected in parallel using splitters and combiners made from Sage Wireline. Each unit is based on one dual MOSFET, MRF 151G, from Motorola. The device is rated for 300W when operated at 50Volts and the maximum voltage it can withstand is 125 Volts. We operate it at 28V and extracts around 125Watts of power. At this voltage it is immune to destruction by reflected power. They are mounted on a 5" × 2.5" × .25" copper heat spreader and complete with bias circuits and feedback network. Power from four such units are combined to get the required output power. The splitter is fed by a 20 Watts driver amplifier based on MRF151. The phase and amplitude of the outputs are matched and combined. All the individual units and the driver are mounted on a water cooled heat sink. DC power is supplied by commercially available SMPS units.

3.5.13 Eight Channel Slow Tuner Control Electronics

As the Slow Tuner Electronics NIM module is not capable of providing sufficient current, loading problem generally occurs. So, to rectify this problem, a new Eight channel Slow Tuner Control Electronics module has been made indigenously. This module has been tested two times and is performance is found to be satisfactory. The Valve voltage and Transducer voltage can be read by CAMAC. It is having Eight meters, so at the same time all the eight meter readings can be taken.

3.5.14 Goniometer - XRR Control Module

A mew CAMAC based Gonio -XRR module has been designed and tested . The module controls (i) the motion of the stepper motor for linear motion of a X-ray detector and (ii) the three motors of the Gonio meter. Gonio-XRR module also hosts two important features viz., A 32 bit scalar and a 40 bit clock module. They can be accessed as two independent 16 bit ADC providing respectively the information about the amount of charge deposited by incident ion beam and the absolute time difference between the recorded events. The module is designed in such a way that it removes the overhead of the CPU, after initialization it automatically controls the complete setup accordingly. The off line testing has been done.

3.5.15 Phase meter input module for RF phase monitoring

Commercially available Phase meters works for monitoring AF phase effectively. In order to use them for RF phase monitoring a Phase meter Input Module is Designed and Developed. The module Mixes the RF signal phase to be measured with some offset RF frequency within a few kHz and then extracts the AF signal for phase meter input for monitoring of the RF phase. This will be useful during the tuning of the beam through LINAC.

3.6 ELECTRICAL GROUP ACTIVITIES

U. G. Naik and Raj Kumar

Electrical group is actively involved in taking up new projects and is dedicated to maintaining 100% uptime of the electrical installations.

Maintenance:

3.6.1 Stabilised Power Arrangement

We maintained 1MVA and 500 kVA stabiliser catering to major loads such as A/C plant-II and Helium Compressors and the clean power to NSC pelletron cum experimental areas with 100% uptime without a single breakdown in the supply. 1MVA stabiliser was opened and serviced. We replaced the damaged brushes, voltage correction cards, gears and motor drive cards.

3.6.2 UPS Systems

This year NSC has procured and installed about 4 nos. of 2000 VA and 3000 VA UPS dedicated to some computer and controls for Mat. Science use and placed them temporarily in Target lab. 1 no. 2000VA UPS was also procured and installed in Seminar Hall. NSC has a previous base of about 15 UPS ratings from 2-10 kVA. Most of the UPS are on AMC and during the present year all UPS were very healthy and had 100% uptime. Routine maintenance was carried out by the manufacturers authorised service centre and the faulty batteries were replaced.

3.6.3 Power Factor Compensation

Electrical group has made all efforts to keep up with the unity power factor thereby saving more than Rs. 5 lakhs on the energy billing.

3.6.4 Maintenance of Phase-I & II Electrical Installations

The electrical Group is proud to declare that during this year there was no breakdown, hence the uptime was maintained at 100%. Phase-I electrical installation was put in to operation from November 1989. It has two nos. of 11 kV H.T. feeders from BSES, 2 × 1000 kVA, 3 × 500 kVA transformers, HT Panel, LT panel, 2 × 70 kVA, 2 × 320 kVA, 1 × 100 kVA D. G. Sets and cabling. Electrical distribution network has about 20 nos. of Power Distribution Panels consisting of several ACB's and TPN switches besides lighting and power circuits. To list a few we have carried out following major maintenance works along with day-to-day and routine maintenance in the year 2003-04.

By doing these maintenance, timely and efficiently this group has maintained system in a very healthy and efficient manner and this has reduced the down time.

26 Lifting and Washing of transformer Core, dehydration of Tr. Oil was carried out for transformer 1, 2 and 3 of 500 kVA each.

27 Dehydration of Tr. Oil was carried out for all 5 transformers.

28 Servicing of 1MVA Servo Stabiliser and Dehydration of oil.

29 Oil Circuit Breaker servicing- 7 nos.

30 Air Circuit Breaker servicing- 20 nos.

31 Calibration and setting of Over Current and Earth fault relay- 48 elements.

32 Periodic maintenance of LT panels, Distribution boards and other accessories, Lighting, Fixtures, lighting and power circuits.

33 Testing and treating of earth pits-80 nos.

Painting of 3 × 500 kVA transformers.

3.6.5 Energy Saving

Energy savings measures taken earlier continued in the areas where we had installed the energy saving time switches. We have also succeeded in convincing CPWD to incorporate only energy efficient lighting in the PH-II installations (excluding housing blocks). All the lighting circuits in side the laboratory building has been supplied with a stabilised and reduced voltage thereby saving energy of the order of 20%.

Project Works

3.6.6 Vacuum Circuit Breaker Panel for Sub Station

Electrical group has inspected, tested and installed 3VCB HT panel in the substation as an incomer panel and one outgoing. The group has approached Central Electricity Authority and got their Electrical Inspectors approval to put the panel in to operation. The system was put in to operation from 27th February, 2004.

3.6.7 Communication Equipments

Electrical group also handles the affair of procuring and maintaining Walkie-talkie Hand sets and base stations. Till now we have 10 nos. of hand held stations and one base station. This year we have approached the Ministry of communications for a separate frequency. However due to lot of congestion in the frequencies they have asked us to share the existing frequency for the new sets to be procured for Cryogenic use. The order for these additional sets is placed and shall be put in to use before end of this financial year.

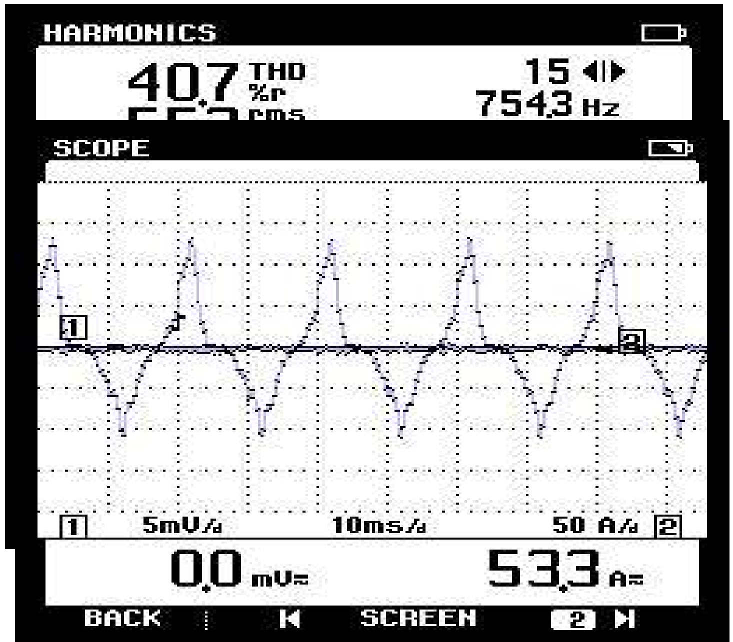
3.6.8 Elimination of Harmonic Distortion in Clean Power Distribution System of NSC

After complete harmonic analysis of clean power distribution system carried out last year following levels of harmonics were found present in the various installations.

	UPS Systems	Emergency Power	Analyzer Magnet	H V Deck – LEIBF	Pelletron E. Power	Switching Magnet
% THD (I)	74.00%	62.00%	15.20%	32.00%	47.00%	58.5%

Out of these installations, UPS Systems, Emergency Power and Pelletron E. Power are all fed from a common panel and all put together impose a THD of around 40.7%. We worked out a Harmonic Filter of 30 Amps rating with 20 selective order of frequencies. We have procured and installed Harmonic Filter of above rating from MG ups, marketed by Shnieder UK. Now after incorporation of this filter the THD has come down to 2%. This is a marvellous achievement in the Harmonics reduction. Fig. 1 shows the harmonic Spectrum of load current. Wave shape of load current is shown in Fig. 2.
Fig. 3 is wave shape of Total bus current waveform after installing the active filter.

Fig. 1 Harmonics Spectrum



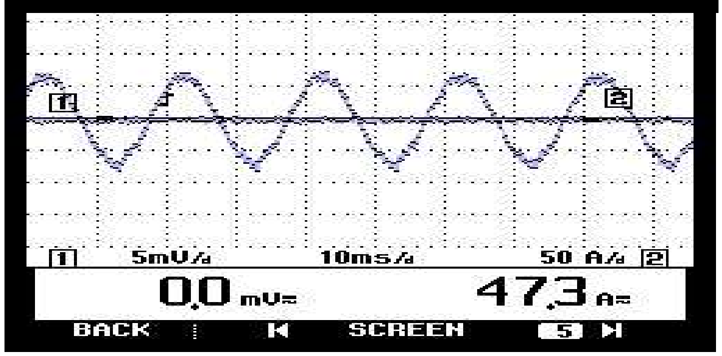


Fig. 2 Wave shape of load current

Fig. 3 Wave shape of Total bus current waveform after installing the active filter.

3.6.9 Phase-II Part-II Installations

Electrical group has been working in close co-ordination with the CPWD to make sure that the requirements as per the user input and as per the standards are followed in the project by CPWD. Progress is good, all the LT cables are delivered at site, concealed conduiting is done and tenders for other services such as LAN, Paging and telephone is finalised.

3.7 COMPUTER AND COMMUNICATIONS

S. Bhatnagar, S. Mookerjee and E.T. Subramaniyam

The expansion of computational facilities, both hardware and software, continued this year in line with the vision of comprehensive coverage of all activities and groups in the Centre. The following activities deserve a mention.

3.7.1 Augmentation of networks and desktop computing

The number of installed network nodes in the Centre crossed the 350 mark this year, spread across four networks, with the addition of 30 nodes. The networking of the second beam hall and associated labs was completed, and the control and data acquisition networks were reorganized. The shift to a managed network started this year with the introduction of Cisco managed switches on a trial basis. Twenty five desktop PCs were also added this year in the labs and sections. A similar number of existing PCs were upgraded. Network laser printers have also been introduced this year, to potentially replace individual inkjet printers completely.

3.7.2 Augmentation of central servers

The workhorse linux terminal servers for the academic and administration networks were further upgraded this year in line with increasing usage. A new Linux-based mail server was introduced on the Ernet link, to start off the shift from the proprietary Silicon Graphics Irix-based web/mail/proxy server to fully public domain solutions. The LAM/MPI distributed processing compute cluster was overhauled and made fully operational, and now comprises sixteen hyper-threaded Xeon processors.

3.7.3 Software augmentation and development

The move towards the use of public domain software wherever feasible continued, with an increase in the number of stand-alone and terminal server Linux users, and practically all internet and mail usage from client PCs now on Linux-based solutions. An important development effort this year saw the implementation and upgradation of a web and Linux based package for personnel and accounts administration; a feature is the possibility of access to commonly required information by the Centre's staff through a friendly web interface.

3.7.4 Internet services

A major upgrade of both Internet links was completed this year, more than trebling the Centre's total bandwidth. The Ernet radio link was upgraded from 64 Kbps and the Spectranet link from 256 Kbps, both to 512 Kbps. Among other benefits, this greatly eases the use of online journals.

3.8 AIR CONDITIONING, WATER SYSTEM AND COOLING EQUIPMENTS

P. Gupta, A. J. Malyadri and B. Kumar

Central AC Plant

NSC's Central Air Conditioning / Low temperature Cooling System of Phase-1 consisting of 400 TR Central AC plant, performed with 100% uptime. Proper maintenance ensured that the safety record of the plant was maintained at 100% and the power consumption kept at optimum levels. The reciprocating compressors have logged in approximately 75,000 hours each. Other rotary equipment have logged in about 1,14,250 continuous run hours. The yearly maintenance costs have been maintained at approximately 3% of the installed project cost. The equipment being into their fifteenth year of sustained operations have far outlived their economic lives. In the current year, plenty of repair activities were carried out. This was essential to set forward the reliability of the equipment. Considering the age of the equipment, a replacement policy has been taken up in the Xth plan period, based on the real time health of the individual equipment. One Compressor of 100 TR has been replaced by a new one in the current year.

The Phase-II, Central AC Plant with a Centrifugal Chiller and with its installed capacity of 250 TR performed to an uptime of 75%. The plant was under breakdown for 3 months as the thrust bearings of centrifugal chiller failed. A complete compressor tear-down had to be carried out to replace the thrust bearings and high speed shaft. Major part of down time was due to long delivery period in importing of spares. However, Phase-II activities have not hampered for want of the above breakdown as we were able to take phase-II loads on phase-1 AC Plant. The plant catered to the cryogenic activities and was used extensively for picking up the Phase-I heat loads. This resulted in a huge energy saving.

The highlight of the operation and maintenance of the above systems was the in-house responsibility and supervision provided to the contracts, thereby affecting substantial savings in the price paid for the operation and maintenance contracts.

Water Systems

NSC's centralized water system of phase-I, feeding low temperature cooling water of a total heat removal capacity of 115 TR, potable water supply and the gardening water supply performed to an operational uptime of 100%. This was possible due to the stringent maintenance practices that were followed over the years. The mechanical systems have already overshot 65,000 hours beyond their expected life span. A strict monitoring on the water quality ensured that the flow paths are in healthy condition. Numerous replacement works were carried out.

Cooling Equipments

Availability of these equipment was recorded at around 95%. New equipments were added to cater to additional requirements. Several replacements are being done in a phased manner.

New Construction

Planning for the Phase II, Part-II works in association with CPWD, is nearly completed. The tenders for AC and Water are ready with CPWD. Execution is expected to start in the next Financial Year.

3.9 MECHANICAL WORKSHOP

Rewa Ram, Saini S.K, R. Ahuja, S. Sunder Rao and Jimson Zacharias

The mechanical workshop have both machine shop as well as welding shop facilities. The Machine shop is equipped with a CNC lathe machine, three conventional lathes, two milling machines, one cylindrical grinding machine, one tool and cutter grinding machine, one radial drilling machine etc. One vertical milling machine and another lathe machine have been ordered and will be installed in the new workshop building. Most of these machines are fitted with digital read outs (DRO) to achieve higher accuracy and better productivity. Apart from these machines we have horizontal and vertical band saw machines, sand blasting machine. We also have a CAD facility, Solid Works for the design and drafting purpose. A new workshop building is coming up and planning has been done for upgrading of the facility.

The Welding shop is having many high quality TIG welding facilities. Some of the TIG machines can give pulsed arc for the thin section welding. Air Plasma cutter with a capacity to cut up to 40 mm thickness of stainless steel is used extensively. Aluminum welding and oxy-acetylene cutting and brazing set ups are also available.

Another major facility, the Electron Beam Welding, which was set up for the indigenous fabrication of quarter wave niobium resonators is fully operational. After the parameter development for the niobium material, we have successfully welded the niobium Resonator parts. The first indigenous resonator fabrication is completed and tested. Two more resonators are being fabricated. The repair work of some old resonators is also taken up and successfully done. Workshop also provides necessary support for the part machining and fixture fabrication.

All the machines, mentioned above, are working in good conditions, because of timely maintenance and careful handling. Apart from the people engaged in the workshop, other academic personnel and students are also capable of handling the machines.

NSC workshop is providing apprentice training for the ITI passed students in both welding shop as well as in the machine shop. Basic workshop training is provided for PhD students enrolled in NSC. Apprentices enrolled in the workshop enhanced the work output from the workshop considerably. Workshop personnel take both theory and practical classes for the apprentices engaged with NSC.

Workshop is associated with most of the labs for the design, fabrication and installation of the experimental setups for LINAC, Low Energy Ion Beam Facility (LEIBF), Ion Source Test Bench and many laboratories of NSC. Most of the beam line hardware are being fabricated in the workshop. A lot of effort have been made for the procurement of equipment, tools and consumables for the smooth functioning of the workshop as well as for the users' requirements for the experiments. A good inventory of the materials and tools procured is maintained for this purpose. Workshop always gives top priority to the urgent jobs coming from Pelletron laboratory and university users doing experiments using ion beam at NSC.

3.10 HEALTH PHYSICS

S.P. Lochab and R.G. Sonkawade

Health physics group is involved in the various activities of the research and development work. In addition to the radiation safety related to accelerator, radioactive targets, personnel monitoring some activities on environmental monitoring are started. Recently the helium exploration using radon as tracer for geo-thermal springs, mixed radiation attenuation studies on polymers and the geological soil sample analysis using high resolution HPGE detector has been started. Quite a few universities are interested in this kind of work.

3.10.1. Radon Monitoring and its applications to earth sciences

R.G. Sonkawade and S.P. Lochab

The development work on radon studies and its applications to various fields has been taken up and a few of the works have been highlighted here.

3.10.1.1 Natural and Accelerator Generated Radiation Dosimetry Around the 15UD Pelletron Accelerator Facility at NSC

R.G. Sonkawade, D. Kanjilal, P. Gupta, and R. C. Ramola[1]

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Natural and accelerator generated effective radiation dose in and around the vertical 15UD Pelletron particle accelerator facility at Nuclear Science Centre (NSC), has been measured. In natural radiation, radon, thoron and their progeny contribute more than 52% of the total dose. The concentration of radon, thoron and their progeny were measured at different locations inside the Pelletron tower by using LR-115 and Alpha Guard technique. The concentration of radon was found to vary with season and the height of the tower. It was found highest at the basement and lowest at the top floor of the tower during summer and rainy season. However, the pattern was found different in winter because of infiltration of outer air from bottom of tower due to the stack effect of air column. The contribution of dose due to the presence of radon, thoron and their progeny is discussed in details. The artificial secondary radiation, gamma and neutron, generated from ion beam were measured by thermoluminescence dosimeter and CR-39 films respectively. The gamma, neutron, radon, thoron and progeny radiation levels at different heights of the accelerator tower have been converted to the effective dose by taking into account the radiation quality factor for different energy and the set formulae. The most dominant neutron energy in the vault and experimental chamber as estimated from fusion evaporation code PACE is ~2-5 MeV for light ion beams (Li, C, O) at the maximum acceleration energy typically ~8MeV/n. For gamma the energy is likely to be less than 1 MeV. The secondary radiation levels neutron and gamma were found well within the permissible limit of 20 mSv. The effective dose due to radon and thoron was found to be 0.3mSv and 0.15 mSv respectively. The resulting values are well within the permissible level of dose due to natural radon and thoron which are 1.43 mSv for radiation workers and 1.10 mSv for general public. The total (artificial and natural) radiation dose in the facility is very well within the permissible limit.

3.10.1.2 Radon as a tracer for Helium exploration in the geothermal springs

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The possibility of trapping the noble gases especially helium for bulk use has recently emerged due to its growing applications in various fields. Radon tracer technique is very good to determine high helium exhalation points. Radon monitoring can be taken up simultaneously to locate the structural weak zones that allow helium permeation. In present investigation, helium and radon studies were carried out in a thermal spring at Sohna (28^0 15' N, 77^0 4' E and altitude 211 meters) in Haryana, India. This spring is situated on a major geological fault commonly known as Sohna fault. The collected sample from this thermal spring is analyzed for helium and radon concentration using Mass Spectrometer Leak Detector and radon emanometer respectively at Nuclear Science Centre. The temperature of Sohna thermal spring is about 48 ^{0}C. The concentration of helium was found to vary from 6000 ppm to 7000 ppm. The radon level in the water of thermal spring was recorded ~70×10^3 Bq/m^3, which is about 10 to 15 times higher than that in normal water. Radon and helium are constantly transported from the earth's interior and vented out through permeable faults zones. It is also planed to have a complete gas analysis by using high resolution gas chromatograph or residual gas analyzer.

3.10.1.3 Comparative Studies of Radon using Solid State Nuclear Track Detectors and Ionization Chamber

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Radon studies were carried out using Solid State Nuclear Track Detectors (passive) and the Alpha Guard detector (active) around the accelerator facility of Nuclear Science Centre in different seasons. Variation of radon level in various floors at different heights of accelerator tower in air-conditioned and non air-conditioned areas were also investigated in each season. It has been observed that the radon concentrations in air-conditioned area is higher than that in the non air-conditioned area which could be due to the molecular diffusion and advective flow as well as ventilation rate. The concentration of radon varied with height and with season. In winter the pattern was different which may be due to the stack effect of air column which causes infiltration of outer air from bottom of the tower and in summer it reverses. The good agreement between the active and passive detector was observed.

3.10.2 Heating Tray (Planchet) for the TLD Reader HARSHAW QS3500

S.P. Lochab, Jimson Zacharia and P.D. Sahare[1]

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The heating tray (planchet) is used to heat the TLD samples inside the TLD Reader Drawer. The irradiated TLD phosphors are stimulated by heating them on the planchet to release the stored energy in the form of luminescence, which is popularly known as Thermally Stimulated Luminescence (TSL).

The heating tray is very important and delicate component of the reader without which the reader will not function. The TLD reader was functioning very erratic and was giving absurd results. The company vendor quoted the cost of this tray to be over Rs. 25000/-. Therefore, the operating manual was read very carefully and it was decided to examine the tray first. When the tray was taken out it was found that the thermocouple bead was detached from the tray. The reader was non- functional for quite some time. We decided to go for an indigenous one.

The heating tray (planchet) is usually made of Kanthal plate with a thermocouple (usually K-type, Chromel-Alumel) spot-welded at the bottom. Fabrication of such a device is a bit difficult for two reasons; firstly, the plate needs to be of proper thickness so that it does not load the driving system (temperature programmer coupled with a step down transformer) beyond its operational power. Making an indentation (depression) on the plate also is not that easy. Moreover, the tray should also be fixed properly in the drawer. Secondly, spot-welding of the thermocouple at the bottom of the tray is a precision work because it has to be spot-welded at a point only and thermocouple should also form a proper bead to read and monitor the temperature of the tray/sample accurately.

To fabricate an indigenous tray, a Kanthal plate of proper width and thickness was procured from the local market. The job of fabricating the tray of exact shape and size was assigned this time to the Physics Department workshop, Delhi University. The spot-welding was done from M/s Kamal Engineering, Trinagar, Delhi. The NSC workshop provided the holes and shape of the planchet in NSC. The tray was then fitted in the reader and was calibrated by melting various compounds of known melting points. It was also calibrated by a second thermocouple placing on the tray and measuring the output voltage corresponding to various temperatures. When known TLD phosphors were read in this reader the appearance of the glow peaks at proper positions also confirmed the successful fabrication of the tray. The reader is now put to its full usage. The cost of this indigenous heating tray (planchet) is. Rs.250/- (Rupees two hundred only) that is 100 times less than the imported one.

3.10.3 Thermoluminesecence & Photoluminescence Characteristics

Most of the interest in TL comes from the possibility of using it in radiation dosimetry. Radiation is an important tool in nuclear and medical research programmes. Since radiation is hazardous, it is necessary to monitor the dose to workers who are involved with such programmes. After exposure in the radiation field these TLDs are heated on a TL reading instrument to measure the thermoluminescence output. The TL output is proportional to the radiation dose it received from the field.

The recent work undertaken by our group is the development of the nano and micro size TL-dosimetry. A few of the studies carried out by us are highlighted here.

3.10.4 Thermoluminescence and Photoluminescence Characteristics of nanocrystalline $LiNaSO_4$:Eu phosphor

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Europium doped $LiNaSO_4$ in its nanocrystalline form has been prepared and its thermoluminescence (TL) properties are studied. The TL glow curve of the phosphor has been found to have a simple structure with a single peak at 432 K. Though the highly sensitive commercially available TL phosphor LiF: Mg,Cu,P (TLD-700H) is about 1.5 times more sensitive than the nanocrystalline material, the sensitivity of the concerned nanomaterial is much higher (~10 times) than the other standard phosphor TLD-100 (LiF: Mg,Ti). Compared to the conventional $LiNaSO_4$:Eu phosphor (prepared through a melting procedure and having particle size of 125 μm), the nano-sized phosphor has a lesser TL sensitivity. However this reduction in TL sensitivity on decreasing the particle size from micrometers to nanometres gives a better understanding of the TL phenomena. The order of TL kinetics for the concerned nanomaterial is also found to be different from that of the conventional material. Photoluminescence studies that have been performed on these materials throw light on the reasons for such a change in the order of kinetics. Further, fading and reusability of the concerned nanomaterial is also studied and it is found that the phosphor is quite suitable for radiation dosimetry.

3.10.5 Effect of Tb^{3+} Co-doping and particle size on $K_2Ca_2(SO_4)_3$:Eu Phosphor

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$K_2Ca_2(SO_4)_3$ doped with Eu, and co-doped with Tb were prepared by the solid state diffusion method. The formation of the compounds was confirmed by XRD. The particle size was calculated by the broadening of the XRD peaks using Scherrer's formula. The particle size was found to be around 20 nm. Thermoluminescence (TL) was studied to see the effect of co-doping and particle size. Tb^{3+} co-doping decreases the intensity in the Eu^{2+} doped phosphor due to the energy transfer and multiple de-excitations through various radiative and non-radiative processes. The $K_2Ca_2(SO_4)_3$:Eu,Tb phosphor is found to be 0.33 times more sensitive than TLD-700H, but around 15 times more than LiF-TLD 100, and 7 times more than $CaSO_4$:Dy. The effective atomic number Z_{eff} is around 15, which is again comparable to $CaSO_4$:Dy.

However, very low sensitivity was observed in the case of nanoparticles. The decrease in the sensitivity is attributed to the particle size effect i.e., the volume-to-surface ratio. Study of photoluminescence (PL) of the material is also carried out.

3.10.6 Thermoluminescence and Photoluminescence Characteristics of nanocrystalline $BaSO_4$:Dy phosphor

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Nanocrystalline Dysprosium doped alkaline earth sulphate, $BaSO_4$, has been prepared by co-precipitation method. Microcrystalline sample was also prepared by well-known acid method. Formation of the compound and crystal structure was confirmed by XRD. The particles size was estimated from broadening of the XRD peak using Scherrer's formula. The particle size was approximately found to be 20 nm. Thermoluminescence was studied to see the effect of the particle size. The glow curve of the microparticles compound has two peaks at 127 ^{0}C and 168 ^{0}C, but the glow curve of the nanopartcles compound has three peaks, two small peaks at 148 ^{0}C and 197 ^{0}C and a very prominent peak at 304 ^{0}C. The $BaSO_4$:Dy micro and nano-particle phosphors are found to be 0.44 and 0.15 times sensitive than TLD-700H and 20 and 7 times more than LiF-TLD 100, respectively. Decrease in TL intensity for the nanocrystalline materials has been attributed to the higher surface to volume ratio. It might also be possible that the ionizing radiation might have done more damage in case of the nanoparticle than in case of microcrystalline material, which could have resulted in the less production of defects and in less TL intensity. The PL emission spectra of both the samples excited by 418 nm show three peaks at 485 nm, 530 nm and 573 nm.

3.10.7 Preparation and characterization of nanocrystalline MgB4O7:Dy for Radiation Dosimetry using Thermoluminescence Technique.

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Magnesium borate activated by dysprosium (MgB_4O_7:Dy) is a low-Z_{eff}, tissue-equivalent material that is commonly used for dosimetry of ionizing radiations using thermoluminescence (TL) technique. Nanocrystals of the same material are produced and their TL characteristics are studied. It is found that MgB_4O_7:Dy with a dopant concentration of 1500 ppm is most sensitive with its sensitivity equal to 1.12 times that of the standard phosphor TLD-100 (LiF:Mg,Ti). The glow curve is very simple with just a single peak at around 162 ^{0}C. Characterization of the nanocrystalline phosphor is done using XRD and photoluminescence (PL) techniques. Considering the low fading, excellent reusability and an easy method of preparation of the nanomaterial, it is found to be quite suitable as a TLD phosphor.

3.11 CIVIL WORKS

M.K.Gupta and Avinash Gupta

Civil section is associated with the following activities:

- Major expansion Project (right now Phase II – Part II expansion)

* Minor Projects
* Minor Works (additions, alterations, renovation in the existing Civil works)
* Civil Maintenance
* External Cleaning of the Campus
* Liasion with various Government and outside agencies for statutory approvals and various civic problems

Important Civil Activities during the Year 2003-04

Following important Civil works were undertaken during the year 2003-04 in addition to routine Civil maintenance and minor works:

34 Construction of main structure of Materials Science Lab., Lab. 2, Utility Building III and Guest House building under Phase II- Part II expansion project

35 PVC partitions in Beam Hall - II stores

36 Erection of steel staircase for access to Beam Hall -I roof

37 Ceramic floor tiles in toilets of Phase I housings, Flatlets and Hostel block

38 Ceramic floor tiles in Lab building toilets

39 Concreting of Badminton Court

40 PVC partitions in R.No.107 and 102

41 Melamine polish on wooden panelling of Seminar Hall

42 Modification of Beam Hall II rolling shutter

43 PVC flooring in Director's room

44 Finalization of plans of Beam Hall-III building and submission to DDA

45 Painting of Miscellaneous Laboratory Complex buildings

3.12 SF_6 GAS STORAGE & GAS HANDLING SYSTEM, COMPRESSED AIR SYSTEM, MECHANICAL PUMPS AND MATERIAL HANDLING EQUIPMENTS

K.K. Soni, Bishamber Kumar and Rajpal Sharma

i) SF_6 Storage and Gas handling: 37 Tones of SF_6 Gas is stored in 5 Nos of 150 M^3 each pressure Vessels. With routine checks and timely maintenance, SF_6 system has been performing well and gas leakage through system is minimum. Further with operational skilness, SF_6 quality has been maintained with Dew point better than - 65 degree Centigrade.

Four pressure vessels of SF_6 which were installed 15 years back were opened and cleaned from inside. All the O ring gaskets and fasteners of these pressure vessels are changed. Corrosion of the vessels are checked and found well within limit The tanks are pneumatically tested to 1.10 times of design pressure for it's future satisfactory performance. Thorough inspection and testing (as per SMPV rules) of Relief Valves installed on storage tanks are also carried out to ensure the soundness of the pressure vessels and subsequently the storage license is sent for renewal from the chief controller of explosives of India.

ii) Compressed Air System: Compressed air plant (Ph-I and PH-II) consisting of reciprocating compressors (2 Nos.), screw compressor, air dryer and filters with capacity of 3000 lpm @ 9.00 kg/cm^2 have been maintaining uninterrupted air supply to tower, Beam Hall- I, Beam Hall-II and various laboratories round the clock. Pneumatic connections have been extended to all the labs. Further to ensure dew point of the air, the compressed air is passed through two refrigerated type air dryers of 4300LPM capacity. Ultra high filters (boro silicate based) are provided in different location of the compressed air to provide clean air free from dust and oil particles. Reciprocating compressors are more power consuming and source of excess oil contamination in the compressed air. Two reciprocating compressors are replaced by one Screw Air Compressor of 2208 Lpm capacity.

iii) Industrial Gases: Various industrial gases required in different labs have been made available from time to time. Special gases like Iso Butane and mixture gases are also procured for labs.

iv) Elevator: Elevator has been running smoothly and monthly preventive maintenance of the same is carried out to minimise the operational break down.

v) Material Handling System: Periodic maintenance / servicing of all E.O.T cranes and electric hoists for Ph-I and Ph-II is being carried out periodically and the same have been working smoothly. Operational guidance for handling of scientific equipment / setup from one place to other is given whenever required.

Two more cranes of 2 Tonne capacity are installed in EBWM room and Material Storage area.

All the cranes are put on remote control operation for safe handling.

vi) Fire Extinguishers: Annual refilling and periodic maintenance of all the fire extinguishers have been carried out. New fire extinguishers have been installed in newly constructed BH II store area. Some more signal including the "Escape route" in emergency is added in the building with GLOW LIGHT which shines even in darkness.

Rotary Vacuum Pumps: Periodic maintenance and repair of pumps have been carried out.

Indigenous Development of Parts: MG I has made serious efforts to develop the substitute of imported items being used in the Pelletron system and gas handling system. Coupling units for rotating shafts have been made.

3.13 DATA SUPPORT LABORATORY

V.V.V. Satyanarayana and P. Sugathan

Apart from providing regular user support for experimental setup in data room, this year the Data Support Laboratory developed a few Electronic Modules, Serviced Radiation Monitors, and procured data acquisition Electronic Modules, connectors, cables etc.

3.13.1 Isolation of Data Acquisition LAN

The data room LAN has been separated from main academic network for the purpose of isolating the data acquisition servers. The data room system now consists of two on line data acquisition stations DAS1 and DAS2 connected to CAMAC and using freedom software. Two more system with CD writing facility is provided for users to transfer files and backup the data onto CDs. The other local data acquisition system running at different beam lines are also connected to the network. A router is configured between the main network and data acquisition networks so that users can transfer files to other hosts in the main network.

3.13.2 Development of Low Cost Data Acquisition Systems

Low Cost Data Acquisition system containing a charged particle detector, pulse processing electronics and data acquisition module has been developed. The system uses a solar cell based detector, preamplifier, shaping amplifier, and peak detection ADC all inbuilt on a single motherboard interfaced to computer through printer port. Converted digital data is read and displayed by software running on Linux OS. Ten number of such systems have been assembled and tested. The systems are given to university users for regular use in universities. One such system had been used as stand alone MCA for NSC data room users.

3.13.3 Servicing and Maintenance

A few numbers of neutron and gamma radiation monitors installed at different locations of the accelerator and beam lines were serviced and repaired. The problem causing malfunctioning of these radiation sensors was identified as the failure of ICs and associated circuitry. In addition to this a Shaping Amplifier and Quad CFD have also been serviced.

3.13.4 Data Support Lab has acquired the following Electronic modules for data acquisition resource pool

1. 567 EG & G Ortec Time to Amplitude converter - 2nos.
2. 556 EG & G Ortec High Voltage Power supply (3 kV) - 2nos.
3. 974 EG & G Ortec Quad 100MHz Counter/Timer - 1no.
4. 710 EG & G Ortec Quad 1KV Bias supply - 1 no.
5. 3296-Z1A Philips Data way Display control - 1 no.
6. 2022 Canberra Spectroscopy Amplifier - 1 no.
7. 2100-2 Canberra NIM Bin power supply - 1 no.
8. 7186 CAMAC 16 channel, 12 bit TDC-Philips - 1 no.
9. 6954 Single channel 100kHz - 1GHz Amplifier - 1 no.
10. 425 In-line Isolation Transformer - 1 no.
11. 460 Inverting Transformer - 2 nos.