1. ACCELERATOR

1.1 OPERATIONAL SUMMARY

S.Chopra

The accelerator operation in this year had been smooth and there were no major breakdowns in the accelerator. The operational summary of the accelerator is as follows for the period 04-04-2002 To 31-03-2003.

Total No. of Chain Hours	=	7905 Hours
Actually Used	=	4848 Hours
Machine breakdown	=	310 Hours
Accelerator Conditioning and MC - SNICS installation	=	2200 Hours
Beam Change Time	=	259 Hours
Facility Testing	=	288 Hours

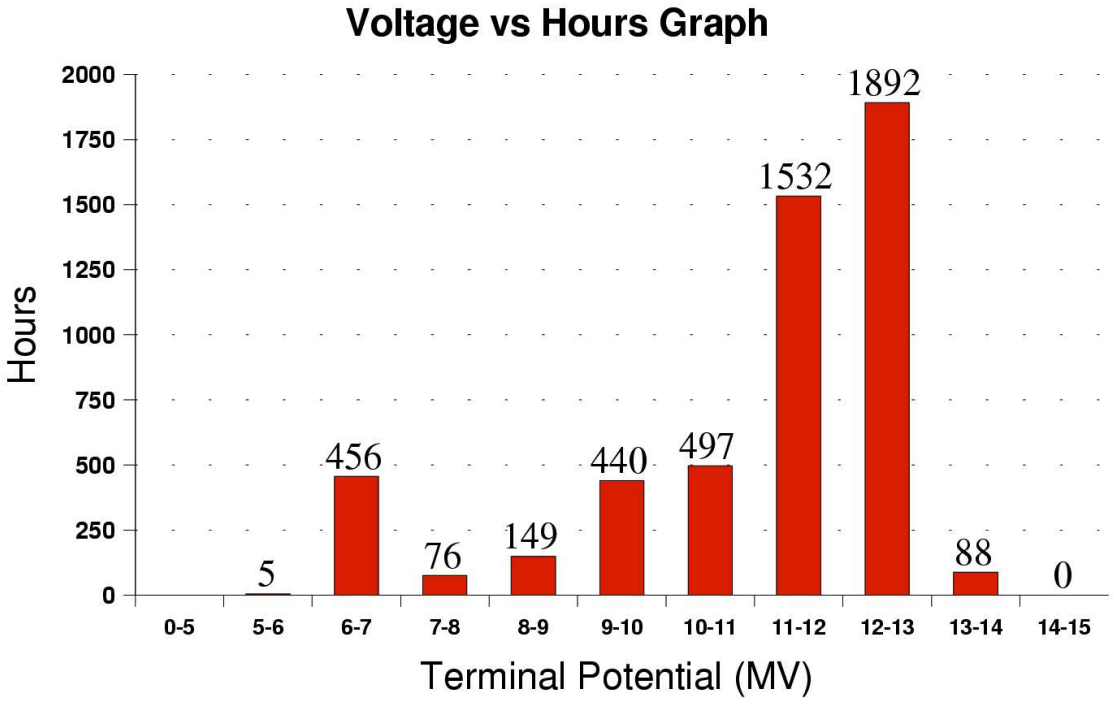

Fig. 1 : Voltage vs hours graph for the 15 UD Pelletron

During the above mentioned period the total number of 642 shifts were used for experiment. Out of these 642 shifts, 202 shifts were used for Indian National Gamma Array (INGA) experiments. The machine uptime for this period is 96% and the beam utilization is 64.97%. The voltage distribution of the Terminal Potential used for different ex-

periments in the year is shown in Fig. 1. The maximum voltage achieved during conditioning in this year was 14.0 MV.

The total duration of beam run for above mentioned period is 5136 hrs. Duration of run time in percentage for different ions is shown in Fig. 2.

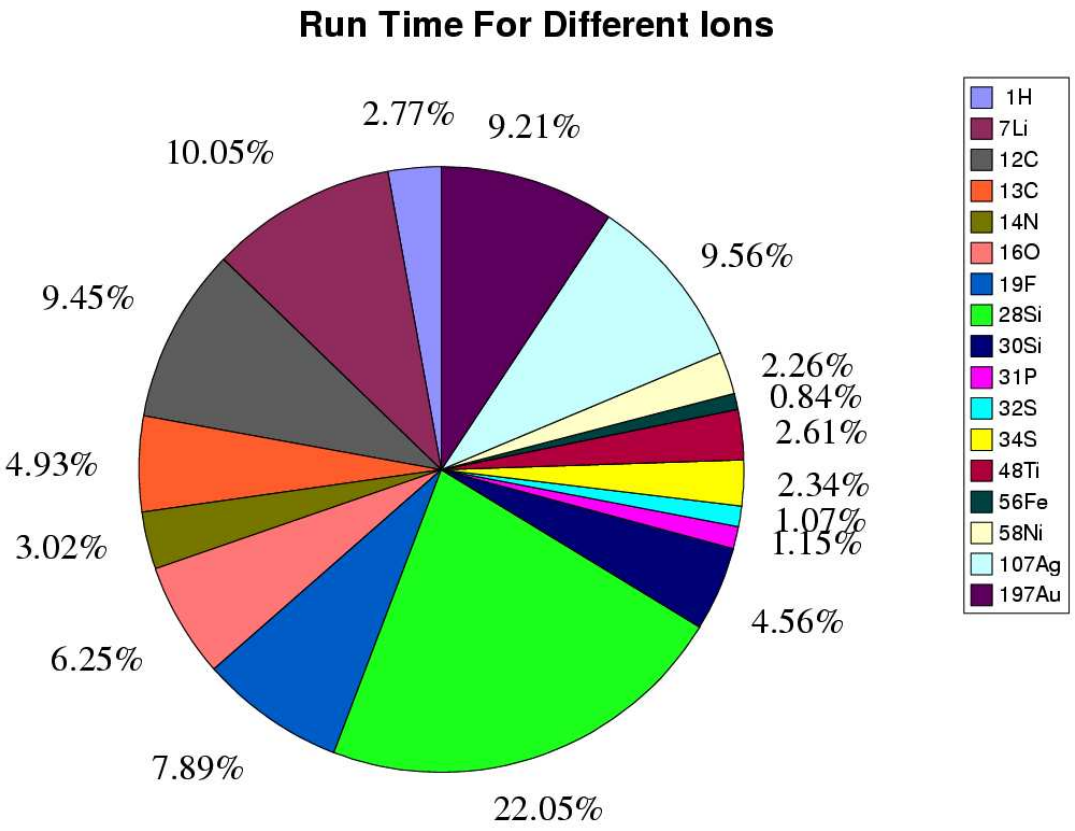

Fig. 2 : Run time for different ions during 2002-2003

1.2 MAINTENANCE AND DEVELOPMENT ACTIVITIES

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There were 3 tank openings in this year out of which 1 was scheduled and other 2 were unscheduled. The major activities during these tank openings were related to accelerator preventive as well as breakdown maintenance apart from foil stripper change in terminal.

A bunch of new fiber optic cables was installed from tank top to Low Energy Dead Section, replacing damaged fiber optic cables. These damaged fiber optic cables were repaired earlier to control the operation of devices inside low energy dead section.

Pneumatic straight through valve of vault area was replaced. It was leaking in closed position. Fast acting valve just after injector magnet was also replaced. It had a leak from body. Both these valves are working fine since then.

Quadrupoles of column top and dead section D-1 were made operational. This was done to look in to the possibility of further increase in transmission through machine.

The unscheduled tank openings were mainly due to formation of some conducting layer between column support post electrodes and hoop screws. These conducting layers were flashing across, and consequently restricting the terminal potential build up. These screws were replaced in unit 10 and unit 23. Changing of all the screws of machine will be done soon.

1.3 ION SOURCE

S Gargari, K Devarani, M Sota, S Ojha, V Patel, J Prasad, R Kumar, M P Singh, N S Panwar, S Mohan, Suraj Kumar and S Chopra.

The performance of ion source injector was satisfactory this year. During this period some major development work has been done in ion source. Since the commissioning of Accelerator we had been using Single Cathode SNICS, up to June 2002. In July 2002, a 40 sample Multi cathode SNICS has been installed in the ion-source. In the month of August 2002 the MC-SNICS has been tested and it is fully operational now.

During the first five months of this year, the single cathode SNICS worked well. The source was opened once only for regular maintenance in February 2002. In the month of July 2002,during installation of MC-SNICS, the old source was removed from the deck and the einzel lens were also removed. The new einzel lens and the source have been assembled. The alignment part was very crucial because the beam has to go through the machine. Alignment was done using a laser beam. The alignment was done within a fraction of a mm. Compared to the previous source, control parameters are more in this new source, and the cooling system is totally different. All the power supplies were installed and connected to CAMAC for remote operation. New cooling system has been installed out side the deck and the new interlock points have been installed also.

TABLE 1
Typical beams from MC-SNICS at FC-02

Beam	FC-02 (μA)
7Li	1.5
12C	15
13C	8
16O	15
28Si	14

Beam	FC-02 (μA)
107Ag	1.5
197Au	20

After installing the MC-SNICS, it was tested for a few days. Operation of MC-SNICS is in many ways different from old SNICS. Here Cs supply should always be kept on. Without proper voltage to the cesium focus lens, no beam comes out from the source. Very high currents were measured at faraday cup after mass selector. Total time taken for cathode changing to develop a new beam is now less than two minutes.

1.4 OPERATION AND MAINTENANCE OF BEAM PULSING SYSTEM

R Joshi, S Ojha, M Sota, P Barua and S K Datta

Beam pulsing system performed satisfactorily during the period of one year starting from 1st April 2002 to 31st March 2003. During this period there were 9 pulsed beam runs. ^{7}Li, ^{16}O, ^{19}F and ^{31}P were bunched. 124 shifts of pulsed beam were given to user. Time resolution of bunched beam varied between 2.0 - 2.5 ns. Repetition rate was 1 μs for ^{7}Li beam and 250ns for other species. All the pulse beam runs were stable throughout.

The regular preventive maintenance of Beam pulsing system was carried out for the smooth operation. However, there were a few occasions when breakdown maintenance of the system was also done. The problems were encountered in the electronics control of all three components (Buncher, chopper and TWD). All the problems were rectified within short duration. Out of 124 shifts of pulsed beam operation only one shift was lost due to this breakdown maintenance.

1.5 ACCELERATOR MASS SPECTROMETRY (AMS)

T. Nandi, S.Chopra, S. Gargari, K. Devarani and S.K. Datta

Continuing effort on the development of AMS for Pelletron this year include installation of multi-cathode SNICS, off-line testing of Wien filter, chemical processing of ^{10}Be samples and its online testing. These are briefly described below. Besides, we have made an arrangement to make use of either solid state telescope or gas ionization telescope depending on need of the experiments.

1.5.1 Off-line testing of the Wien filter as procured from Danfysik

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Wien filter or velocity filter is very essential for rejecting unwanted particles from stable isotope beam before it reaches the detector. Two different kinds of analyzer needed to select the ions of a particular velocity are a magnetic analyzer to select a beam with required values of MT/q^2 and an electrostatic analyzer to select T / q values. Here T is kinetic energy, q the ionic charge and M the mass of the ion. Once magnetic rigidity MT/q^2 is constrained by electrostatic rigidity T/q, M/q remains a constant, thereby, T/M, the velocity is fixed within the resolution set by the two fields. As a result, Wien filter or velocity selector rejects unwanted ions from the spectrum and enhance the degree of resolution.

In Wien filter, an electric field (E) and magnetic field (B) are oriented at right angles to each other as well as to the direction of the motion of ions. For testing Wien filter, one ^{241}Am alpha source was mounted on an extender with an Al-collimator and proper electronic setup was used. The source was mounted on one side of the Wine filter and a silicon surface barrier detector was on other side. Experiment was carried out at ~$2x10^{-6}$ mbar pressure in the Wien filter chamber. ±49 kV bias were applied (maximum limit ± 50 kV) through Glassman power supply to the pair of parallel plates. Nominal leakage current of less than one micro Ampere was observed.

A magnetic field was applied to the chamber and 0-0.4 Tesla were measured using a Hall probe and a Tesla meter. Alpha count rate was first measured without electric and magnetic field, then with increasing electric and magnetic fields separately. It was found that the count rate decrease with increasing both fields individually but not diminishing to zero. In the final step electric (E) and magnetic (B) field was applied to a such value that ratio E / B is equal to the velocity of the 5.5 MeV alpha particles. In this case it was found that the alpha count rates came back to that without field. It was observed that higher the E and B, alpha spectrum was cleaner. Thus it can be concluded that the Wien filter is working properly.

1.5.2 Testing of BeO samples as processed from Mn-nodules using AMS

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Accelerator Mass Spectrometer facility test was carried out using BeO extracted from geological samples for ^{10}Be measurement. The Be was separated from Mn-nodules

using a chemical procedure developed at Pondicherry University. The outer layers of the Mn nodules were separated from the inner layers, 0.5 gm of each inner and outer layers were digested using *aqua regia*. 1 ml of 1000 ppm ^{9}Be standard solution was added to the samples. Further 1 ml of 1000 ppm ^{9}Be standard solution was taken as blank. Be was eluted in cation exchange column (Bio-Rad, AG® 50W-XB Resin) using 1N HCl. For removing organic matter, Fe and Mn sample were treated with aqua regia, and Fe, Mn eluted in column by using 1N HNO_3. ^{10}Be occurs at very low concentration in natural materials; typically 1×10^{10} atoms/g in young marine sediments, 1×10^{6} atoms/g in *in situ* irradiated quartz. Some improvement is needed in chemical procedure to get more ^{10}Be.

BeO sample as processed form Mn-noddules and BeO blank were loaded in the MC-SNICS. AMS methods were followed to tune the invisible beam of 10 mass units (^{10}B and ^{10}Be) and charge state 3^{+} obtained from BeO sample to the detector placed at GPSC. We found that BeO sample contains higher concentration of ^{10}B than ^{10}Be (10^{6}:1) and similar thing was observed in case of the blank also. So it is not known at this stage whether the BeO sample contains any ^{10}Be. Mass Spectroscopy was done at the Faraday cup placed after injector magnet (FC-02). It shows the presence of different mass numbers in the sample ranging from M = 1-58. In order to circumvent this practical problem, improvements are needed in the chemical procedure for sample preparation, as well as in the gas detector (MAGIC) for reducing ^{10}B count.