INTER UNIVERSITY ACCELERATOR CENTRE

An Inter University Research Facility of UGC

New Delhi, India

Historical dates of Events

DATES	EVENTS
JUN. 19, 1984	The Govt. of India accepted and approved the concept of Inter University Centre
JUL. 9, 1986	Foundation work started
DEC. 11, 1986	Statutory Permission from DDA to start construction
SEP. 30, 1988	The Centre was registered under the Societies Registration Act, XXI of 1860
DEC. 19, 1988	The Centre becomes autonomous
DEC. 19, 1990	Pelletron Accelerator commissioned and dedicated to the nation by Minister of HRD
JUL. 8, 1991	First Pelletron User Experiment performed
AUG. 1991	Gamma Detector Array (GDA) commissioned
DEC. 1991	Heavy ion Reaction Analyser (HIRA) operational
MAR. 1993	Materials Science Beam Line Commissioned
JUN. 1994	Radiation Biology Beam Line Commissioned
MAR. 1996	HIRA-GDA (8 HPGe detectors) coupled facility commissioned
JUN. 26, 1996	LN2 plant commissioning
MAR. 1997	Cryogenic Plant operational
APR.10, 1997	LHe plant commissioning (CCI make)
MAR. 28, 1998	1st off-line LHe transfer to a cryostat (MPC)
DEC. 1998	First Radioactive Ion Beam, 7Be, produced using HIRA
MAR.14, 2001	1st on-line cooldown of LHe distribution line and Buncher cryostat
DEC. 2001	Super Buncher Commissioned
FEB. 2002	Resonator Fabrication Facility Commissioned
MAY 2002	HIRA-INGA (old, 8 Clover Ge detectors) coupled facility based first nuclear physics experiment
SEP. 24, 2004	Commissioning of 1st Module of LINAC
JAN. 2005	Commissioning of High Temperature Superconducting ECR Ion Source
MAR.10, 2005	AMS beamline in beam hall 1 commissioned
MAY 9, 2005	^{10}Be signal detected from standard sample using AMS facility at IUAC (first time in the country)
JUN. 2005	The Centre renamed as INTER-UNIVERSITY ACCELERATOR CENTRE
AUG.23, 2005	Successful detection of 10Be from Manganese Nodules using AMS facility at IUAC.
SEP. 24, 2005	Inauguration of the new Materials Science and LEIB Building
DEC. 2005	Commissioning of old Neutron array (24 detectors) in Beam Hall II
AUG. 12, 2006	Inauguration of Engineering Building
FEB. 2008	INGA campaign 1st phase at IUAC (with 14 Clovers) starts
DEC. 2008	Commissioning of Hybrid Recoil mass Analyzer (HYRA) 1st phase
APR. 27,2010	Inauguration of High Performance Computing Facility
MAY 26, 2010	Successful detection of 26Al signal from standard samples using AMS facility at IUAC.
JUN. 2010	HYRA – TIFR Spin Spectrometer coupled facility based first nuclear physics experiment
SEP.15, 2010	AMS Clean chemistry laboratory inaugurated by Secretary, Ministry of Earth Sciences, Govt of India
AUG. 5, 2011	Commissioning of second LINAC accelerating Module
FEB. 22, 2012	LHe plant commissioning (LINDE make)
APR. 27, 2012	UGC in its 484th Meeting recommends status of Institution of National Importance for IUAC
DEC. 7, 2012	Commissioning of third LINAC accelerating Module
JAN. 2013	Focal plane isomer studies using HYRA – first experiment
DEC. 17, 2014	Fund received from DAE-BRNS to start FEL activity
JUN.4, 2015	New AMS facility for ^{14}C, ^{10}Be & ^{26}Al based on dedicated 500kV Pelletron accelerator operational
JUN. 2015	New NAND array (100 detectors) based first nuclear physics experiment
SEP, 2015	Establishment of National Geochronology Facility
MAY 2016	INGA campaign at IUAC starts
FEB 2019	Inauguration of Maharshi Kanad Auditorium of IUAC
FEB 2020	Supercomputing facility of the compute power of 3 PF of National Supercomputing Mission (NSM-EB)

Vision

We open new windows to the young minds of our nation and strengthen the pool of scientists by building a brighter future through scientific understanding.

Mission

In the quest of innovation & capacity building in the areas of accelerator driven research, IUAC is India's premier laboratory for university researchers.

Our mission is to provide necessary powerful tools used by scientists to understand the mysteries of matter, energy, space and time by looking at the processes that works at the bigger, smaller and faster scales.

The basic objective of Inter-University Accelerator Centre (IUAC) is to provide front ranking accelerator based research facilities for internationally competitive research in multi-disciplinary areas. The Centre, as the first inter-university research institute within the University system, has been playing a crucial role with its Scientific and Technical staff having dual responsibility of facilitating cutting-edge research for a large user community as well conducting their own research and development to open new vistas of advanced research activities. Emphasis is laid on encouraging group activities and sharing of the facilities at the Centre in synergy with those existing elsewhere. The Centre has designed and commissioned various sophisticated accelerator systems and experimental facilities, in project mode, involving several universities/institutes for research in the areas of Nuclear Physics, Materials Science, Ion-Molecule Collisions, Atomic Physics, Radiation Biology, Radiation Physics and Accelerator Mass Spectrometry. More than 700 research groups from Universities, Institutes and Laboratories, from India and abroad, have been using the facilities round the clock, seven days a week, for nearly three decades.

Values:

- **User Support**
  We make every user feel welcome and respected and encourage all to contribute.
- **Excellence**
  Without compromising safety, security or the environment we hold ourselves to the highest standards, continually looking for ways to improve our work, advance our skills and make the best use of our experience and talent.
- **Integrity**
  We are honest and transparent in our conduct, communication and research practices by making ourselves accountable for our actions.
- **Collaboration**
  We celebrate our individual strengths and talents while acknowledging that we achieve more by performing pioneering research with national and global partners.
- **Creativity**
  Developing self-reliance by indigenous development and implementing new ideas with courage and confidence for competitiveness.

Objectives:

IUAC has always been interested in setting up Accelerator facilities keeping in mind:

1. **Fill-in the Gap:** IUAC has set up various Ion Accelerators which have contributed significantly in the fields of basic sciences. IUAC can provide medium to heavy accelerated ions but does not have Electron Accelerators as well as Ion Accelerators to perform mass spectrometric studies for medium to heavy radio-isotopes.
2. **New Research Areas:** By setting up these Accelerators, IUAC will contribute in opening up of the new fields of research in Earth Sciences as well as in Space research.
3. **Capacity Building:** IUAC, being a research institute, will contribute in the capacity building in above fields as well as these programmes will broaden the scope of present mandate of IUAC.
4. **Internationalisation:** IUAC as an institute will have better funding opportunities as well as more possibilities of adding manpower for strengthening the present infrastructure of IUAC.

With a modest start with Pelletron, at present IUAC has**7 operational Ion accelerators –**

1. **16 MV Pelletron Accelerator – Energized Ion beam – Tens to hundreds of MeV**
2. **Superconducting Linear Accelerator – Energy Booster – Hundreds of MeV**
3. **Low Energy Ion Beam Facility – tens of keV to a few MeV**
4. **Negative Ion Implanter – upto 200 keV**
5. **1.7 MV Pelletron Accelerator – a few MeV**
6. **500 kV Pelletron Accelerator – hundreds of keV to a few MeV**
7. **50 kV Ion Implanter Facility – few keV to tens of keV**

3 more Accelerators are coming up

1. **6 MV Pelletron Accelerator – for Accelerator Mass spectrometry**
2. **Free Electron Laser – THz radiation and electron beam – multidisciplinary research**
3. **High Current Injector – Injector to SC-LINAC – produce noble gas and metal ions**

Inter-University Accelerator Centre (IUAC), earlier known as Nuclear Science Centre (NSC), is an autonomous Inter University Centre established in the year 1984 by University Grants Commission (UGC) under the Ministry of Human Resource Development (MHRD). The Centre, which came up as a green-field project, is spread over 25 acres of land provided by Jawaharlal Nehru University in Qutub Institutional Area of New Delhi. The main aim of the Centre has been to establish a national institute to provide internationally competitive, front-ranking Accelerator based research facilities to the researchers from Indian Universities, Research Institutes and other National Laboratories in the fields of Nuclear Science, Materials Science, Radiation Biology, Atomic Physics, Accelerator Mass Spectrometry, etc. The Centre was established, considering the great demand in the Indian research community, to not only provide accelerator based research facilities but also to develop world class accelerators and research programmes.

The construction of the Laboratory Complex and other infrastructure for establishing the Centre started in the year 1986 and it was dedicated to the nation in 1990. In the short span of four years (1986-1990), the complete infrastructure of the Centre was built which was supposed to be a record time for setting up of an operational accelerator laboratory for carrying out regular experiments using the energetic beams of various ions available from the Accelerator. The Centre became fully operational in the year 1991, and since then it has been fulfilling its mandate by providing research facilities round-the-clock to more than 700 research groups from nearly 160 Universities, 85 Colleges and 60 other National laboratories. Till now, more than eleven hundred fifty Ph.D. Scholars completed their theses using the state of the art research facilities of the Centre, A large number of research papers have been published in reputed international refereed science citation indexed (SCI) journals. In the year 2005, Nuclear Science Centre was renamed as Inter- University Accelerator Centre (IUAC), which reflects the character and mandate of the Centre.

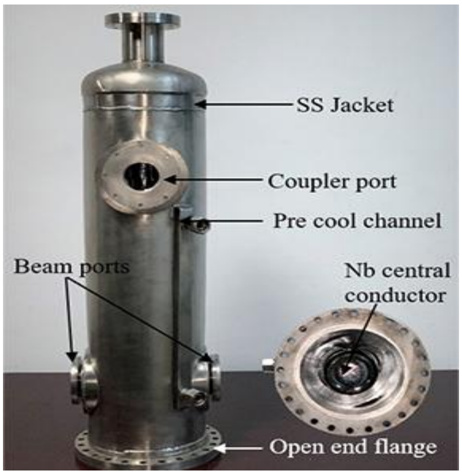
Why a Particle / Ion Accelerator for Research?

Question may arise as to the use of an accelerator. Basically, an accelerator produces charged particles of one type of nuclei, speeds them up to a few per cent of the speed of light using electromagnetic fields and bombards the particles on to a target consisting a , usually, different set of nuclei. Surrounding the collision zone are various kinds of detectors which record the many remnants and radiation produced in the reaction process. Accelerators thus solve two problems for physicists. First, since all particles behave like waves, physicists use accelerators to increase a particle's momentum, thus decreasing its wavelength enough that physicists can use it to probe tine confines inside atoms and nuclei. The accelerator is today's most powerful microscope. The resolving power is linked to the wavelength of the accelerated particles, which is equal to h/p, where h is Planck's constant and p is the momentum of the particle. This shows that larger the momentum the smaller is the wavelength, which makes it possible to achieve the high resolution needed to explore the interior of matter. At high particle energies the interior of matter can be explored with a resolution that other probes like visible light cannot achieve. Also, the energy of accelerated particles is used to create the other unstable particles, which usually do not exist in nature, which physicists wish to study. With more powerful accelerators and higher collision energies more massive and sometimes new types of particles can be discovered and studied. Two nuclei cannot come close enough because of the repulsive Coulomb force acting between their constituent positively charged protons. High velocity of nuclei implies high energy of incident nuclei, enabling them to overcome the repulsion and reach close enough to target nuclei so that the short range, strong attractive nuclear force will lead to nuclear reactions. High velocity ions are deflected by atoms of target material and this helps in Materials Analysis i.e. to know the composition of any target material. The effects of accelerated charged particles on biological systems at the molecular level and on crucial semicondutor chips used in satellites (which encounter energetic charged particles in outer space) also give us idea about the induced radiation effects of the ion beams. AMS or Accelerator Mass Spectrometry is used to measure very low concentration (of the order of 1 in 10^{15}***) of trace elements. Long lived radioisotopes, produced through nuclear reactions, serve as tracers and chronometers in many branches of science, e.g. Geology, Archeology, Hydrology, Environmental Science, Bio-medicine, Cosmo-Chemistry, Nuclear Physics, etc. AMS is also used to determine isotopes at infinitesimal trace levels in semiconductors, geological samples and other materials.***

Ion Accelerators at IUAC Delhi

IUAC has commissioned different types of accelerators such as Tandem Van de Graaff Accelerators, Superconducting Linear Accelerator, Radio Frequency Quadrupole and Drift Tube LINAC for High Current injector, Electron Cyclotron Resonance ion source based ion implanters, negative ion implanter, etc. These accelerators can provide a wide range of ion energies from few tens of eV to several hundreds of MeV. In addition, IUAC has designed and commissioned many advanced experimental facilities for research and a High Performance Computing facility for the researchers from all over the country.

The 15UD Pelletron Accelerator: It is a Tandem Van de Graaff Ion accelerator and is the biggest in India and one of the world's about half a dozen operational large Tandem Accelerators with terminal potential above 15 Million Volts. The 15UD Pelletron, having terminal potential achievable up to 16MV using compressed geometry accelerating tubes, has been operational since 1990. Thousands of researchers have been utilizing the high energy beams from this Ion Accelerator regularly. The Accelerator is housed in a 26 metre tall pressurised tank within the 50 metre tall tower and is protected with the help of Earthquake Rams. It can accelerate ions of most of the elements in the periodic table. The facility has been extensively used not only for basic research in Nuclear Science, Materials Science, Atomic Physics, Radiation Biology and Earth Sciences but also in many strategic national projects such as the effect of high LET ionising radiation on the electronics components for satellites, Geological Dating of Geological samples and artefacts, Radiation effects on the Cancer Cells, etc. which have societal impact.



The superconducting linear accelerator (SC Linac) at IUAC serves as a booster to the 15 UD Pelletron and is designed to accelerate ion beams upto mass 80 above the coulomb barrier of 5MeV/nucleon for symmetric systems. The SC linac consists of three accelerating modules each housing eight Niobium Quarter Wave Resonators (QWR) and an 8 Tesla superconducting solenoid, a superbuncher and a rebuncher module housing one and two QWRs respectively. The design and development of the linac started in early 90's in collaboration with Argonne National Laboratory (ANL), USA. The resonators are constructed from bulk niobium and are jacketed by an outer vessel of stainless steel. Transitions from stainless steel to niobium are provided through explosively bonded Nb-SS transition flanges. During operation the resonators are bath cooled at 4.2 K with liquid helium. The first milestone was the successful testing of the superbuncher in 2001, followed by the first beam acceleration in 2005. The complete linac has been operational since 2012 and delivering ions beams for user experiments on a routine basis. During beam acceleration, maximum energy gain of 9.6 MeV/q was achieved from the Linac. This energy gain corresponds to an operational accelerating gradient in the QWRs which is typically 5% less than their maximum achievable value.

Low energy Ion Beam Accelerators: Two unique **Low Energy Ion Beam Facilities (LEIBF)** have also been developed and made operational at IUAC. A **positive ion beam facility** has been setup using an Electron Cyclotron Resonance (ECR) ion source mounted on a high voltage deck. The **positive ion accelerator (or ion implanter)** provides multiply charged positive ion beams with a wide range of relatively lower, tunable energy (~ 50 keV to about 3 MeV) for experiments in Atomic, Molecular and Materials Sciences.

Negative Ion Accelerator (Implanter)

Positive Ion Accelerator (Implanter)

The **negative ion accelerator (or implanter)** facility provides negative ion beams up to 200 keV and uses an ion source based on sputtering by cesium ions. This facility is extensively used for ion implantation studies, which have wide applications in pursuit of Materials Science basic research.

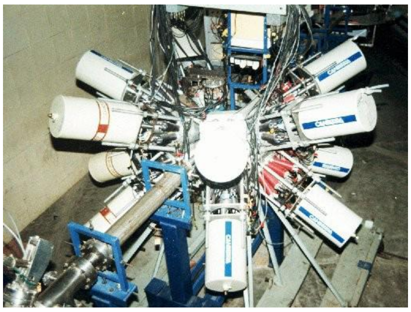
Rutherford Back-Scattering (RBS) facility: A 1.7 MV Pelletron accelerator has been installed at IUAC. The facility is equipped with Alphatros ion source for producing negatively charged He ions, 1.7 MV Pelletron accelerator, a RBS chamber and a 4-axis goniometer. The surface barrier detector measures the number and energy of ions backscattered after colliding with atoms of the sample enabling the determination of atomic mass and elemental concentration versus depth below the surface. H ions can be made available by changing the ion source.

A new state of the art **Accelerator Mass Spectrometry (AMS)** facility for radiocarbon dating has been established at IUAC for dating or time-stamping of geological and prehistoric samples. The facility uses a 500kV Pelletron accelerator and automated graphitization equipment (AGE). AMS is an ultra-sensitive technique (up to a level of ppq) and can be applied for the detection of long-lived radionuclides in many branches of science e.g. Geology, Archaeology, Hydrology, Environmental Science, Bio-medicine, etc. This facility has capabilities to perform ^{10}Be and ^{26}Al measurements as well. The facility is funded by Ministry of Earth Sciences, Govt. of India.

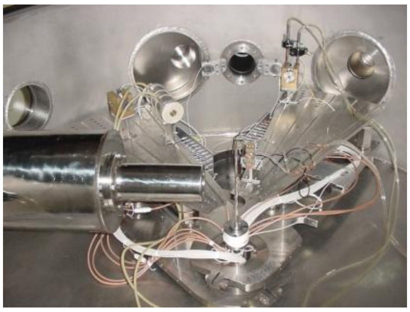
Research Programme at IUAC

The research activities at the Centre are in the areas of Nuclear reactions (transfer, fusion and fission) near Coulomb barrier, High spin spectroscopy, Spectroscopy of highly charged ions, Interaction of swift heavy ions with materials, Characterization and Modification of Materials, Device fabrication, Radiation Biology, Accelerator Mass Spectrometry, Radiation Physics, etc. The advanced experimental facilities at the Centre, many of which are one in a few in the world, are developed and used with active collaboration and participation of the user community. Initial funding for these facilities came from UGC. Other agencies such as DST and BRNS have contributed significantly towards the funding of these facilities.

The **Nuclear Physics** programme covers almost all the current thrust areas (study of stable and unstable nuclei at extreme conditions of excitation energy (temperature), angular momentum and isospin such as nuclear reaction dynamics, target deformation effects, spin distribution studies, role of transfer channels in enhancing sub-barrier fusion cross sections, the dynamical effects of fission delay, nuclear spectroscopy, high spin isomers, Chirality, Magnetic and Anti-magnetic rotations, etc.) through studies of nuclear dynamics and nuclear structure at energies from well below to well above the Coulomb barrier of the various projectile-target systems.

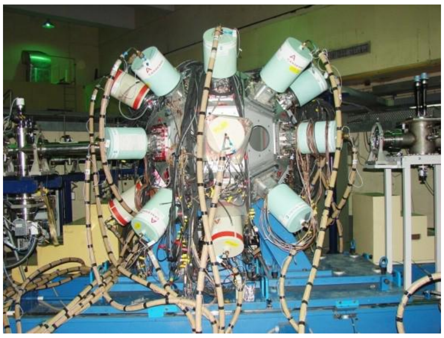


Gamma Detector Array (GDA), consists of 12 Compton suppressed, HPGe detector setup, which was later augmented with a recoil distance based lifetime measuring plunger equipment, a charge particle detector array and an electromagnet for perturbed angular correlation measurement studies.

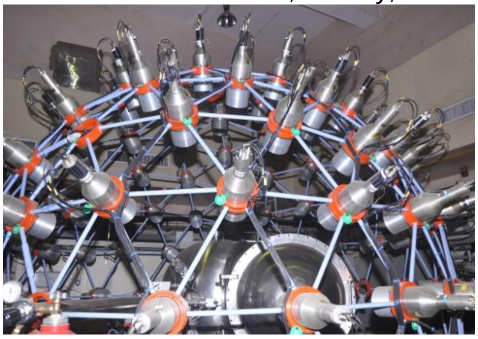


General Purpose Scattering Chamber (GPSC) is being extensively used for both nuclear physics as well as materials science experiments (e.g. the studies of Heavy Ion scattering and transfer reactions above barrier, Projectile Breakup and for ion irradiation).

Heavy Ion Reaction Analyzer (HIRA) is one of the few Recoil Mass Spectrometers (RMS) in the world and the first of its kind in Asia. HIRA facilitates the study of heavy ion induced nuclear reaction dynamics, operates in the direction of primary beam, separates ions of various masses and has provided India's first RIB, namely, ^{7}Be.



The concept of a **national facility for γ-spectroscopy** took shape in early 2000 when a formal agreement between various institutions was achieved for pooling the available resources into **an Indian National Gamma Array (INGA)** consisting of 24 Compton-suppressed Ge Clover detectors with nearly 4π coverage. This is one of a few large gamma detector arrays in the world.

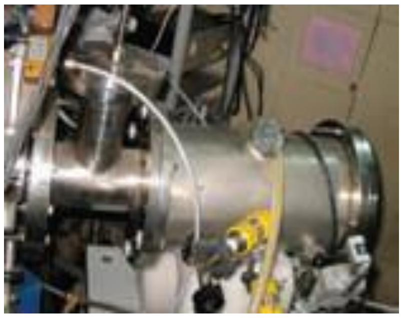


National Array of Neutron Detectors (NAND) is an array of 100 liquid-scintillator based neutron detectors which is used to study fission dynamics through pre- and post- fission neutron multiplicities using beams delivered by Pelletron-LINAC at IUAC. This is one of a few large neutron detector arrays in the world.

HYbrid Recoil mass Analyzer (HYRA) is a unique, state-of-the-art Recoil Mass Spectrometer/Separator in Beam Hall II, which is a dual stage and dual mode device, capable of operating in gas-filled mode and vacuum mode. The 15 m long separator has large background suppression and large efficiency in gas-filled mode and is mass-dispersive with large background suppression in vacuum mode. The vacuum mode can also be used for secondary RIB production. There are only five other gas-filled separators in the world for heavy element detection. The spin spectrometer from TIFR has been coupled to HYRA for unique fusion evaporation residue gated spin distribution measurements and HYRA-INGA combined facility and a dedicated Isomer decay setup at the focal plane are planned to fully exploit the power of the facility. HIRA and HYRA can select one nucleus of interest from among a trillion background particles, all moving together initially.

Materials Science research using energetic ions play a vital role as they can produce systems away from thermodynamic equilibrium. Broadly, these energetic ions are useful in three different ways: (i) synthesis of materials, (ii) modification of materials and (iii) characterization of materials. Areas of activities include Defect engineering, Characterization of materials by Elastic Recoil Detection Analysis (ERDA), Production methods for new materials, Interface modifications / Ion Beam Mixing, Electronic Sputtering and surface modifications, Phase transformations, Synthesis and modification of nano-particles, Ion beam induced epitaxial crystallization and ionluminescence, etc. There are two beam-lines in the two beam halls for irradiation studies with accelerated ions from Pelletron and LINAC. The beam-line in beam hall I includes two irradiation chambers with on-line ERDA, on-line QMA and ionoluminiscence facilities. Low flux irradiation facility for materials science research is also available in another beam-line.

The beam-line in beam hall II has two irradiation chambers with on-line ERDA and in-situ XRD facilities. In-situ Raman facility is also installed in this beam-line. The XRD facility consists of a 3 kW X-ray source with multi-layer mirror, thin film attachment, postion-sensitive Vantage detector and a high speed position sensitive detector besides a conventional NaI (Tl) scintillation counter. A quadrupole mass analyzer system with SIMS option operating at 2.25 MHz that can mass analyze in the range 1-1024 amu, with mass separation ($\Delta M/M$) better than 0.01, is installed in materials science beam-line. The probe consists of 3 lens optics for detecting both positive and negative ions as well as neutral atoms. A large area position sensitive gaseous detector telescope, developed in-house and installed in materials science beam-line is used in on-line measurement of SHI induced compositional changes with good Z resolution. A Raman microscope which allows high resolution con-focal measurements has been installed and tested off-line in the beam hall-II. The system consists of Ar ion laser with 514.5 nm wavelength and 50 mW power. The set-up can also support multiple lasers, with automatic software switching of excitation wavelength. Exceptional sensitivity for ultra-low signal detection, with minimum noise, is possible with a compact thermo-electrically cooled CCD detector.



The Centre also has many off-line characterization facilities including XRD, AFM/MFM/C-AFM, SEM, Raman, Photoluminescence setup, electrical transport / Noise measurement setup, thermoelectric measurement set up, FTIR and UV-Vis/UV-Vis-NIR absorption spectroscopy setup and solar simulator facility. There are several materials synthesis facilities including RF Sputtering, ECR plasma based deposition (under progress), multi pocket e-beam evaporation, Resistive heating evaporation, Atom beam sputtering, Ball-milling, Tubular furnace and Box furnace, etc. A Multi-Mode SPM with Nanoscope is extensively used in AFM, MFM, C-AFM, STM, STS and F-d modes. A field emission scanning electron microscope (FE-SEM, with a resolution of 1.5 nm at 30 kV, has been installed. It has a secondary electron (SE) and a back-scattered electron (BSE) detector for imaging. An energy dispersive X ray detector with 133 keV resolution has also been installed in this system for elemental analysis. A TEM facility with advanced features has been added along with sample preparation facility.

Heavy Ion Radiation Biology is an inter-disciplinary applied science involving Atomic Physics, Nuclear Physics, Molecular Biology and Bio-chemistry. The current research in this field investigates the effects of energetic charged particles on biological systems at the molecular level. The facility provides a laboratory for pre- and post- irradiation treatment of samples. An irradiation system called ASPIRE [Automatic Sample Positioning for Irradiation in Radiation Biology Experiments] is installed at the dedicated Radiation Biology beam-line.

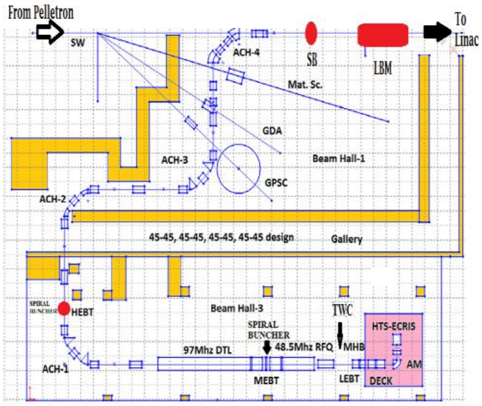
The **Atomic and Molecular Physics** programme at IUAC is based on the two accelerators, the Pelletron-LINAC and the LEIBF. Among the facilities are beam-foil spectroscopy apparatus (both single and multi-foil excitations are used) with X-ray and ion detectors. At the LEIBF, the reaction microscope is used to study molecular dissociation dynamics by using a position-sensitive time-of-flight setup, which has been developed indigenously.

The IUAC High Performance Computing Facility provides supercomputing access to university users across the country, and also provides a boost to the ion-solid, nuclear physics and atomic physics simulation programs at IUAC. The facility is targeted at computational chemists, physicists and biologists in the university system, working in the areas of materials science, atomic and molecular physics and chemistry, radiation biology and nuclear physics.
The original facility, funds for which were sanctioned by the Department of Science and Technology in 2008, was inaugurated in April, 2010 and upgraded in 2012. It was one of the largest in the country, consisting of three systems: a 200-node, 3200 core, 61 teraflop MPI cluster; a 96-node, 768 core, 9 teraflop cluster; and a 80-core shared memory Sun Enterprise server with 256 GB of RAM. Together, the facility was configured to take on a variety of scientific HPC applications, with different requirements of CPU and memory access. A feature of the facility was the data centre housing the distributed computing cluster. With a capacity of 600 servers and associated networking equipment in a space of 50 m^2, this was one of the densest computing facilities. The cold water based in-rack cooling infrastructure was the first such in the country, capable of cooling 20 kW per rack with much better power efficiency than standard data centre precision air conditioning. Till 2019, the facility was used by a hundred and sixty research groups and an estimated five hundred users from a hundred institutions in the country. The usage of the cluster computing infrastructure was also among the highest, and the research domains were diverse. Research work published include results from the exploration of the fragmentation of water molecules by ion impact, electronic and magnetic properties of Heusler alloys, unzipping of DNA under a periodic drive, identification of candidate compounds which act against multi-drug resistant tuberculosis, properties of catalysts for hydrogen fuel cells, and many other areas of great importance for applications and fundamental theory.
The facility is now preparing to resume operations after a major upgrade, with an allocation of a 3 petaflop supercomputer by the National Supercomputing Mission, to be implemented at IUAC by the Centre for Development of Advanced Computing (CDAC). The new systems would greatly enhance the computing power available both to university users across the country and scientists at IUAC, and is expected to provide a fillip to scientific computation in the country.

Accelerator Augmentation

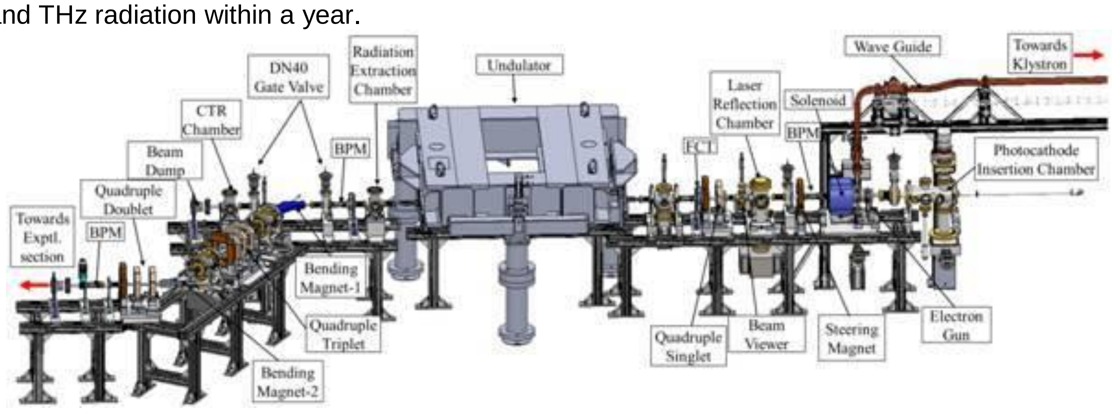
The High Current Injector (HCI) Project will accelerate the ion beam from ECR source using normal temperature Radio-Frequency Quadrupole (RFQ), IH type Drift Tube Linac (DTL) and superconducting low beta cavity module to match the input velocity at our existing superconducting linear accelerator. The 18 GHz HTS ECR ion source of HCI has been in operation for various beam acceleration tests through the downstream RFQ and DTL cavities. The accelerator chain of the HCI facility includes 48.5MHz 4-rod RFQ, operating in cw mode, to accelerate ion beam of A/q of 6 from 8keV/u to 180keV/u. The resonator cavities of the DTL are IH type multiple gap structures. Acceleration from 180 keV/u to 1.8 MeV/u is done by six independently phased cavities.

Different charge states of Ne, N_2, O_2, etc. were developed, extracted and transported for beam tests. Beam acceleration tests were carried out through RFQ, DTL #1 and DTL#2 cavities after installation of all the six DTL cavities, miniature quadrupoles between the DTL cavities, quadrupoles, steerers, achromat #1 and diagnostic devices as per the beam optical design of HCI. A spiral buncher is also located at the entrance of the DTL#1. Beam tests have been carried out in a stepwise manner to carry out the energy gain measurement from RFQ, DTL #1 and DTL#2. All the beam tests have been carried out using N^{5+} beam. The boosted energy achieved from RFQ, DTL#1 and DTL#2 are 180keV/amu, 317keV/amu and 550 keV/amu respectively. The transmission has been optimized for DC as well as bunched beams at the exit of achromat#1. It was observed that the ion current had become almost double when the buncher cavity was powered and optimized for required power level.



Schematic of commissioning of HCI at IUAC, (i.e HCI coupled with SC-LINAC) and the photograph of HCI.

Free Electron Laser – An upcoming facility: To address the growing demand of intense and coherent photon beams in India to conduct experimental research in the field of Physical Science, Biological Science, Materials Science, Medicine, Security, etc., it was decided to develop an accelerator based photon source at IUAC. The name of the facility is Delhi Light Source and it is based on the principle of Pre-bunched Free Electron Laser. In this facility, an intense THz radiation in the frequency range of 0.18 to 3.0 THz will be produced and will be made made available for experiments. In addition, good quality electron beam with an energy upto 8 MeV will be available for other experiments. The beam line design of the entire facility is shown in figure XX. Presently, the facility is at the commissioning stage and it is expected to produce the electron beam and THz radiation within a year.



The design of the complete beam line of the Free Electron Laser facility

National facility for Geochronology (Project of Ministry and earth sciences): Inter University Accelerator Centre (IUAC), an autonomous research center of University Grants Commission (UGC), is setting up a National Geochronology Facility (NGF) with the support from the Ministry of Earth Sciences, Govt of India. Presently, NGF is equipped with Accelerator Mass Spectrometry (AMS) facility for the measurement of ^{14}C, ^{10}Be and ^{26}Al radio nuclides, High Resolution Secondary Ion Mass Spectrometer (HR-SIMS), Q-ICPMS, High resolution magnetic sector ICPMS coupled with femto-second laser ablation system, Scanning Electron Microscope (SEM) with Cathodoluminescence, X-ray diffractometer (XRD) and Wavelength Dispersive X-Ray Fluorescence (WD-XRF) spectrometer. In near future NGF will also be equipped with another Accelerator Mass Spectrometer for medium and heavy mass radio nuclides such as ^{36}Cl, ^{53}Mn, ^{41}Ca, ^{60}Fe, actinides, etc.

Accelerator Mass Spectrometry: A Compact ^{14}C Accelerator Mass Spectrometer eXtended for ^{10}Be and ^{26}Al (XCAMS) at IUAC is used for the measurement of cosmogenic radio nuclides (^{14}C, ^{10}Be and ^{26}Al). XCAMS facility is serving to many researchers in various field areas e.g., geology, oceanography, archaeology, atmospheric science etc.

High Resolution Secondary Ion Mass Spectrometry: A large geometry High Resolution Secondary Ion Mass Spectrometer (HR-SIMS) is under installation and is the first facility of its kind in the country. It finds applications for performing U-Pb geochronology at few micron resolution and measurement of various tracer isotopic composition (O, B, Li, C, S, Fe, Ca, Mg, Hf and Os-Re) of geological importance.

XCAMS Facility

HR-SIMS Facility

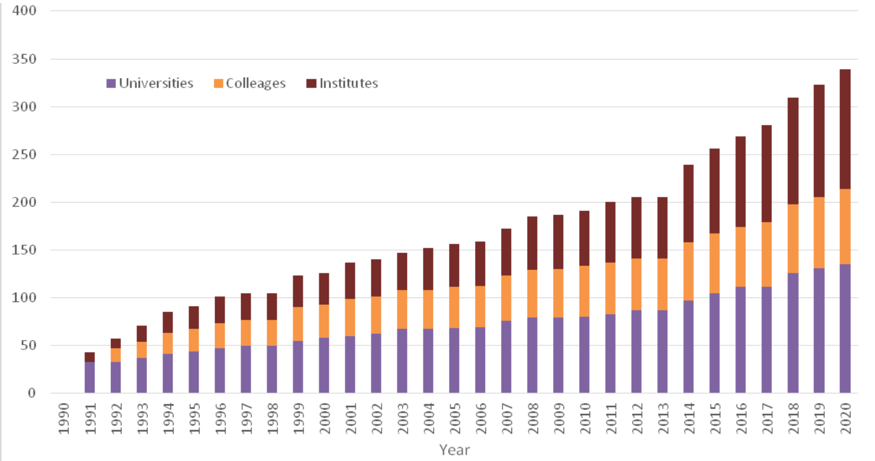
Q-ICPMS and HR-ICPMS with Fs Laser: Quadrupole- inductively Coupled Plasma Mass Spectrometer (Q-ICPMS), High Resolution magnetic sector ICPMS (HR-ICPMS) coupled to a Femtosecond (Fs) Laser are available. Q-ICPMS has regularly been used for trace element and REE measurement and HR-ICPMS has been optimised for in situ U-Pb micro-geochronology of zircon at spatial resolution of 25 μm and is being extended to other accessory minerals.

Scanning Electron Microscope: A high-resolution JEOL make JSM-7610F model Schottky Field Emission Scanning Electron Microscope (FESEM) is commissioned and used for the study of topography and morphology at the micron, sub-micron and nanometre scale with maximum achievable magnification of 10^6.

X-Ray Diffractometer and X-Ray Fluoresence Spectrometry: A PANalytical make EMPYREAN model X-Ray Diffractometer (XRD) is used for scanning of the powder as well as thin-film samples. The XRF facility is a PANalytical make Axios^{max} model Wavelength Dispersive X-Ray fluorescence (WD-XRF) which is used in the qualitative and quantitative geochemical analysis. Further, Jaw crusher, vibratory disc mill, sieve shaker and magnetic isodynamic separator are present at the facility for making fine powder from the rock samples.

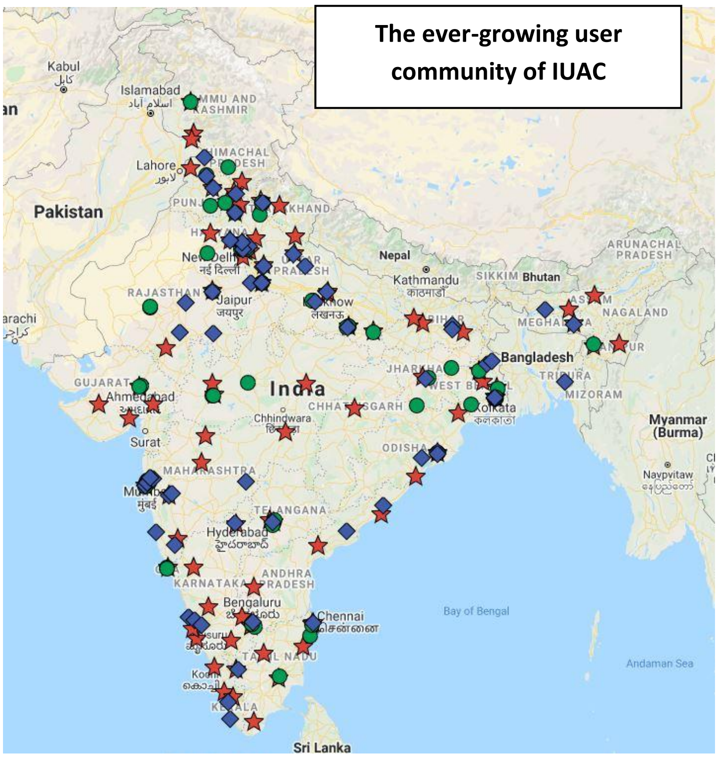
Why an Inter-University Centre

IUAC being an Inter-University Centre, the first in the country, has its main user-base coming from the Universities. The Pelletron-LINAC user base currently has **350 plus faculty members from 135 universities and 79 colleges from the entire length and breadth of the country. In addition, there is participation from the IITs and 120 other national/international research institutions.** Considering all accelerator facilities**,** it is nearly **185 Universities, 100 Colleges and 130 other National/International laboratories.**

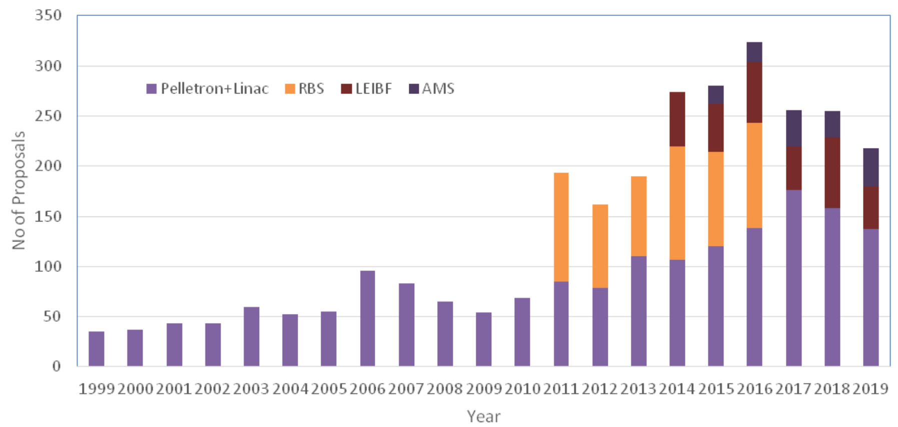


Growth of participating Universities / Colleges / Institutes

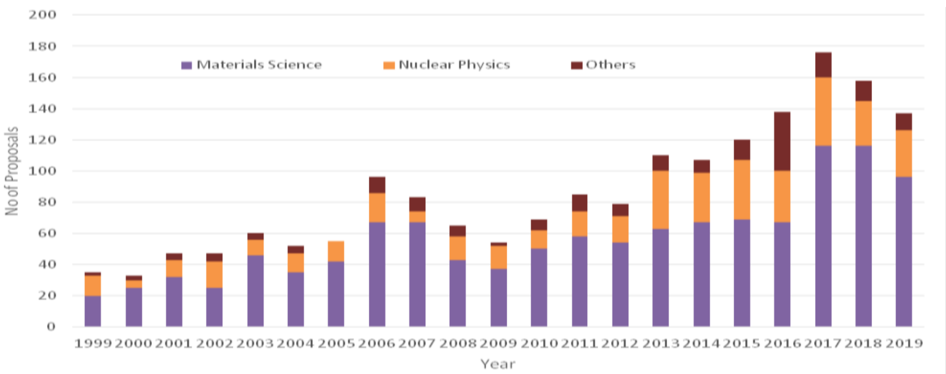
Beam Time Utilization: Selection of the experiments to be conducted using the accelerator is done by a national scientific body called Accelerator User Committee (AUC). To avail accelerator beam time, one must submit beam time proposal to the AUC-Convener. When invited, they should present it before the AUC members during the meeting. The AUC meets twice every year in July and December to evaluate the projects defended by the potential users. A similar procedure is being followed for funding **User Facility for Research Projects (UFR),** as followed for the beam time. It is open to the University users and if approved by AUC, gets funded for three years.



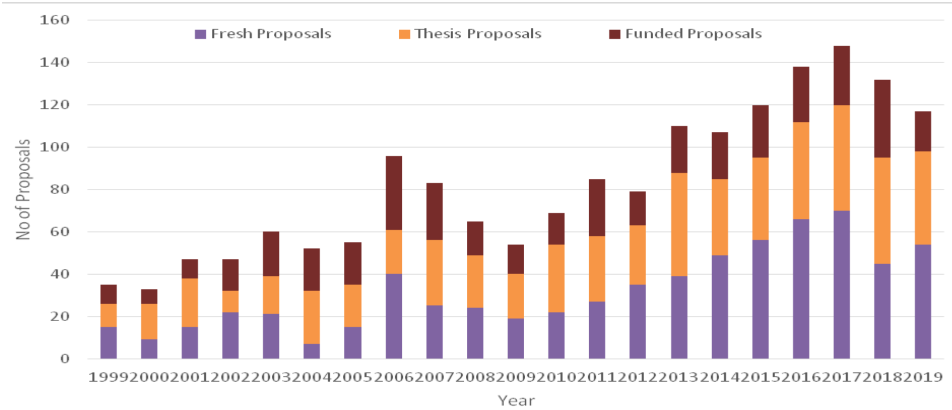
Apart from the Pelletron-LINAC facility, new accelerator facilities, like RBS, Low Energy Ion beam facility, AMS have come up in the last few years. As a result, the number of users (or the number of submitted project proposals) shows a jump as evident from the graphical presentation shown below.



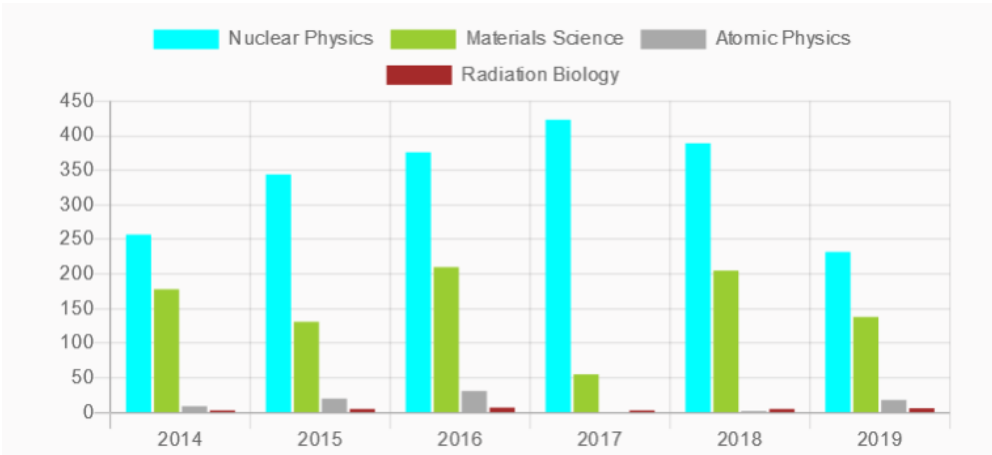
Growth over the years; sanctioned proposals for different accelerator facilities



Growth over the years; sanctioned proposals for different research areas



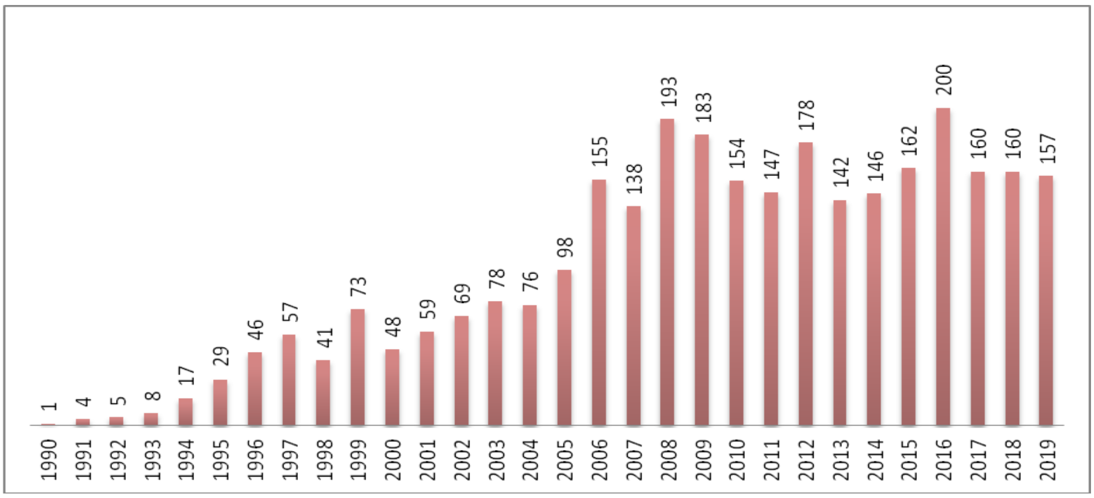
Growth over the years; sanctioned proposals for different types (fresh, thesis & funded)



Shifts utilized for different research areas

The growth in the user base as well as the demand for Beam time is evident from the graphical representations. Several hundred students have completed thesis projects using IUAC facilities. The large number of publications in peer-reviewed international journals based on the research and developmental activities at IUAC bear testimony to the commitment of IUAC towards excellence in experimental research in internationally competitive, advanced fields. IUAC is committed to guide the scientific community using its unique accelerator based research facilities for carrying out focused research in advanced areas of science and technology.

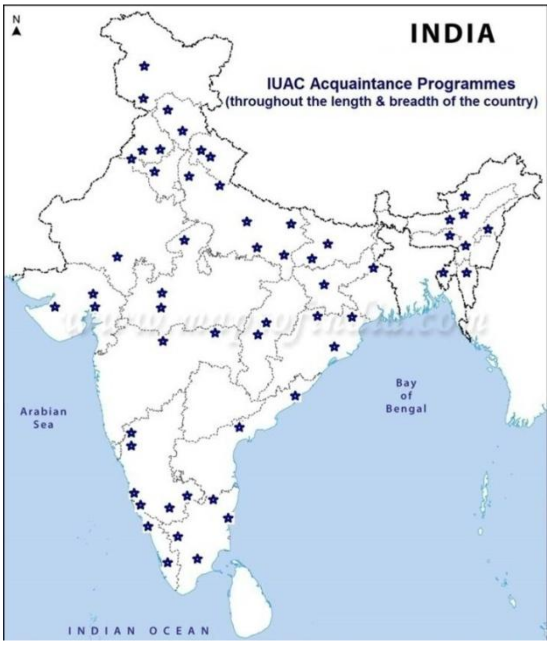
Growth of IUAC Publication over the years

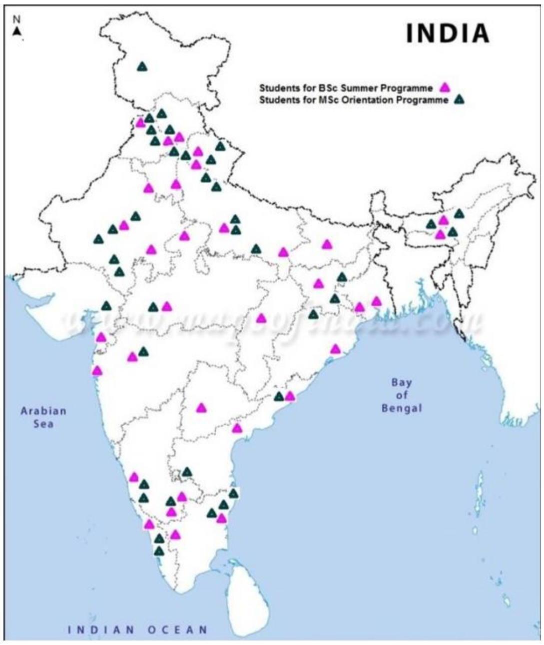


Academic Programmes at IUAC

Summer Programme for B.Sc. (Physics) Students: Students studying in second / third year B. Sc. (Physics) / integrated M. Sc. (Physics) in any Indian college / university / institute and securing minimum 60% marks in all examinations can apply for the summer programme. This programme is held in the month of June every year. The aim of the programme is to give glimpse of research opportunities available in experimental physics and impart hands-on training by scientists to young scholars. Each selected student is expected to carry out a short project in experimental/accelerator physics, guided by a mentor. Upon successful completion of the project, students are required to present their work. A few special lectures and guided tour of the experimental facilities of IUAC is also conducted.

M. Sc. Orientation Programme: Inter-University Accelerator Centre (IUAC) conducts M. Sc. Orientation Programme to encourage interested students to supplement their knowledge and to motivate them to continue their career in science. This programme has been envisaged to provide hands-on training in fields associated with accelerator / ion beam based research to selected M. Sc. students by way of short projects. The duration of M. Sc. Orientation programme is three weeks. It is open throughout the year. Student can apply for this programme based on their convenient time. Applications can be submitted online only. This flexibility allows the students to choose the project period without hampering their main study course.

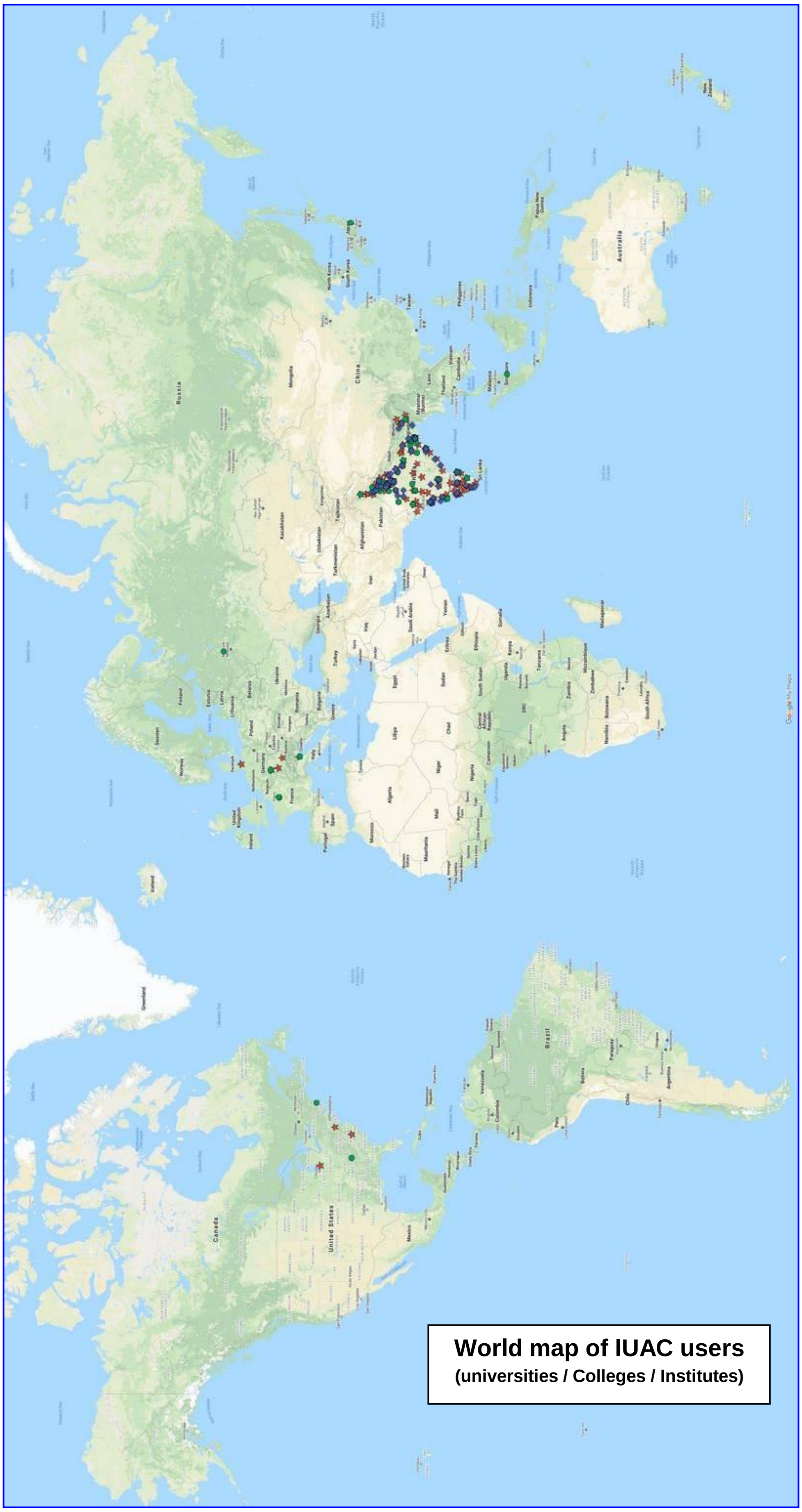




Acquaintance Programme of IUAC is another outreach programme which is conducted in different parts of the country to make the local scientific community aware of the IUAC facilities. The interaction with the IUAC resource persons helps create new potential users for the IUAC facilities. Emphasis is given to hold the programme in those areas from where fewer users exist. The programme is conducted with active participation from a local University/College with one of the existing users as the nodal person.

School/College students' visits to the various facilities are arranged throughout the year at IUAC. Special talks, conducted tours and demonstration of different scientific projects are held on the **National Science Day (Feb. 28th)** for College students and on the **Foundation Day of IUAC (Dec. 19th)** for School students.

IUAC conducts a two semester **PhD Programme** every year for research students and new scientist trainees of the Centre, which is also open to interested University research scholars. The first semester, during August to December, offers courses in Advanced Physics, Experimental Physics, Computational and Programming Techniques, while the second semester during January to May offers courses in Nuclear Physics, Materials Science and Accelerator Physics. Ph.D. research scholars and interested young faculty members from any University, College or research institute pursuing PhD programme can attend these courses.



World map of IUAC users
(universities / Colleges / Institutes)

Towards Self-Reliance: Make-in-India Initiatives

INSTRUMENTATION/ FACILITY DEVELOPMENTS AT IUAC

The facilities also require a lot of custom made electronics, interlocks and control systems solutions which are not available off the shelf and whenever provided by companies are very expensive. There is a need to in-house development of these dedicated electronic modules for control and interlock of these instruments. There are requirements for many types of high voltage/high current power supplies. IUAC has developed in-house expertise for many such necessities such as nuclear experiments related electronics, vacuum interlocks, radiation safety interlocks, magnet power supplies, high/low power RF amplifiers etc.

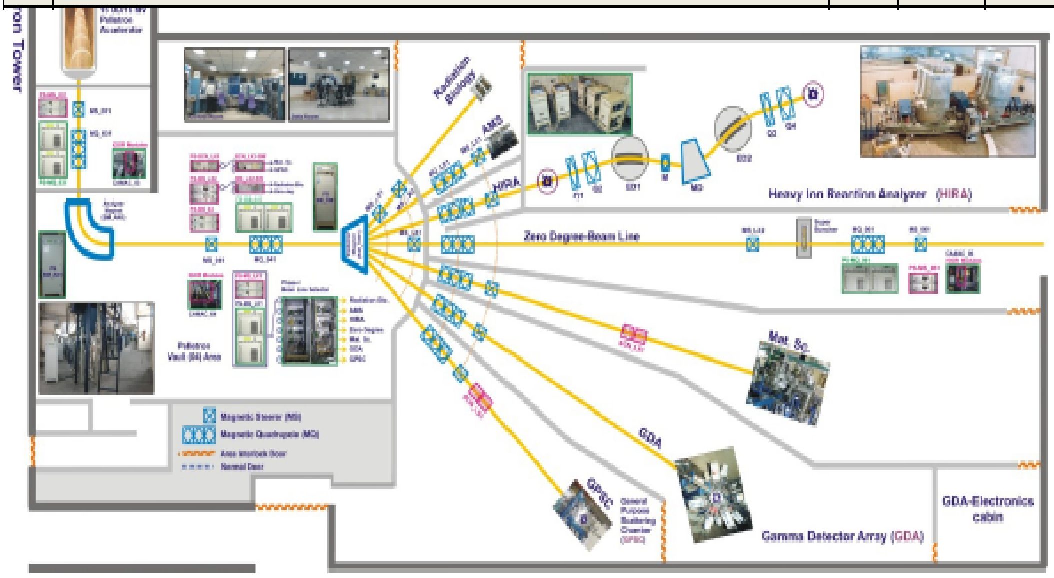
The development of novel systems also requires support from mechanical groups for designing and machining of dedicated systems. Such requirements are necessary for, say, design and manufacture of gaseous detectors (PPACs, MWPCs etc) as well detector mounting arrangements for GDA, INGA, NAND national facilities for nuclear physics experiments. Technical support for maintenance of various beamlines including control, vacuum and interlock systems also necessitates support of trained technical manpower. Most of the materials science and nuclear physics experiments as well as strippers for accelerators require sample/target preparation facilities which also need technical support for optimizing the parameters for such processes.

Many electronics modules, power supplies, operation and control systems and related instrumentation have been developed at IUAC and some in these developed by different groups is summarized below:

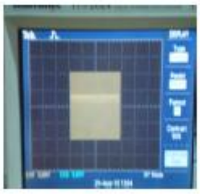
Facility wise Instrumentation development

Phase-I (Pelletron) Beam Transport System

	Description	Qty	Year	Status
01	Bipolar Triangular wave current regulated power supply for Scanning Magnet (± 5A /± 50V, 100Hz)	02	1996	In-operation
02	Bipolar current regulated Supply for Steerer Magnet (±5A/5A, 50PPM)	10	1998	In-operation
03	Beam-Line selector switch for magnetic Scanner/Steerers	02	1999	In-operation
04	CAMAC based 16-Bit IGOR modules for remote control of MPS	20	2000	In-operation
05	Wein-Filter High Voltage Power Supply (± 50kV /1mA)	01	2003	In -operation

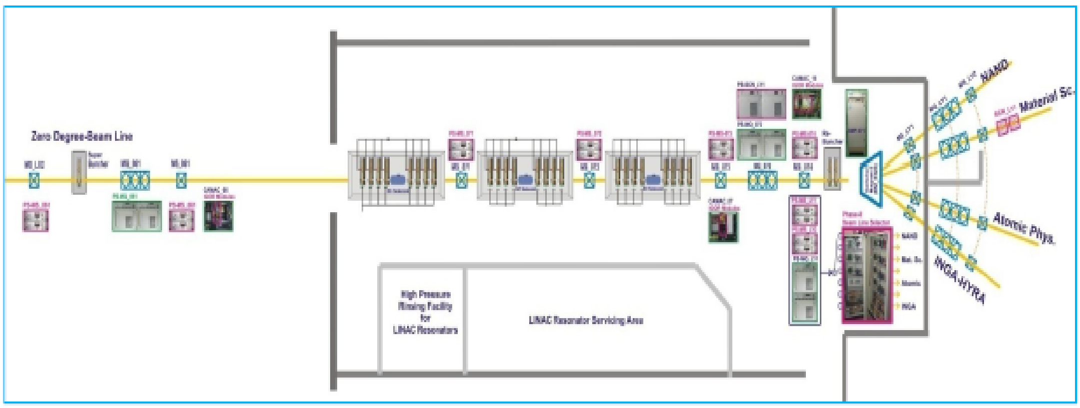


Photographs: Instrument developed for Phase –I (Pelletron)



Facility wise Instrumentation development

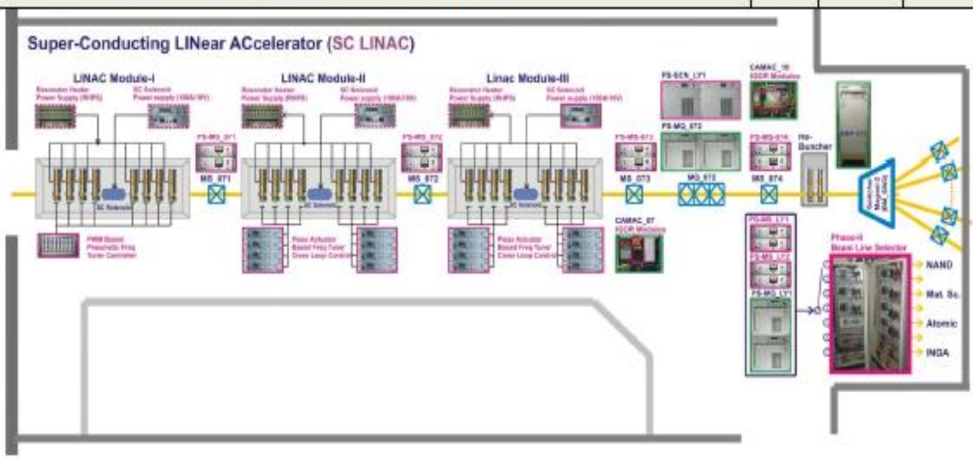
Phase-II (Linac) Beam Transport System (2000-2007)				
	Description	Qty	Year	Status
1	Bipolar current regulated Supply for Steerer Magnet (±5A/5A, 50PPM)	16	2003	In-operation
2	CAMAC based 16-Bit IGOR modules for remote control of power supplies	20	2003	In-operation
3	7- Position Beam line selection switch gear system for Phase-II beam lines	01	2003	In-operation
4	Faraday Cup Controller-Suppressor (400V), Solenoid (24VDC & 110VAC)	10	2003	In-operation
5	Spark Protection Module	30	2003	In-operation



Photographs: Instrument developed for Phase –II (Linac)

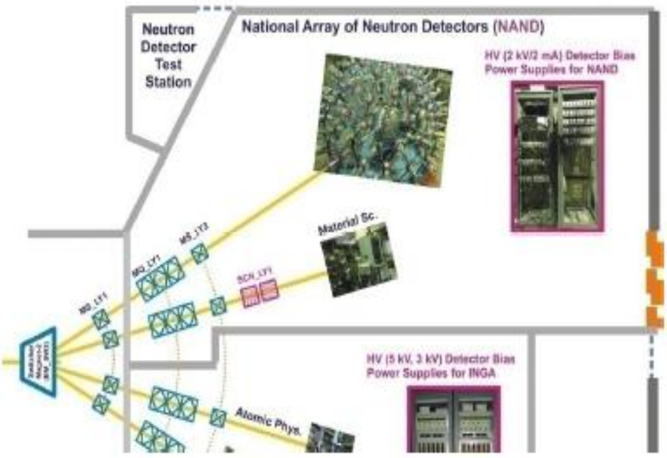
Facility wise Instrumentation development

Linac Accelerator (2008-2014)				
	Description	Qty	Year	Status
1	Super Conducting Magnet Power Supply (100A/10V) -Full Bridge Switch Mode Convertor-CC/CV	03	2008	Not used
2	Super Conducting Magnet Power Supply Programmer – Io Ramp control, PCS operation & Quench det.	03	2008	Not used
3	CAMAC based remote controller for Super Conducting Magnet Power Supply	03	2008	Not used
4	Resonator Heater Power Supply (10W)	24	2010	Not used
5	Controller for Piezo-Actuator based slow tuner mechanism of SCQWR	16	2014	In-operation



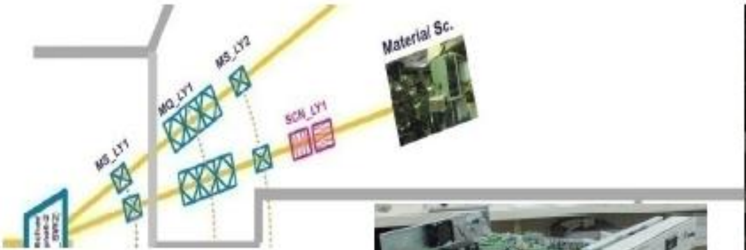
Photographs: Instrument developed for Linac

Facility wise Instrumentation development: NAND



NAND Experimental Facilities (2008-2014)				
	Description	Qty	Year	Status
1	24-Channel HV (2 kV/ 2.5mA) supply to bias Scintillator Detectors	72	2013	In-operation
2	24-Channel (±12V, 2A) Pre-Amplifier Power Supply	05	2013	In Operation

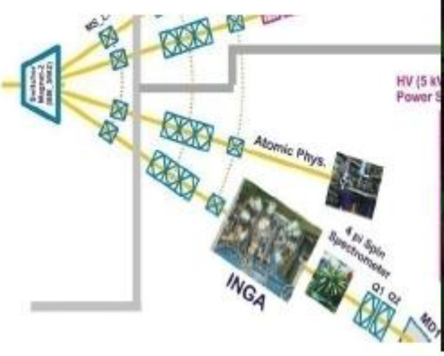
Facility wise Instrumentation development: Mat Sc





Mat Sc. Experimental Facility				
	Description	Qty	Year	Status
1	Bipolar Triangular wave current regulated supply for High Field Scanning Magnet (± 75A /± 50V, 100Hz)	02	2006	In-operation
2	CAMAC based remote control module for Scanning magnet Power Supply	02	2007	In Operation

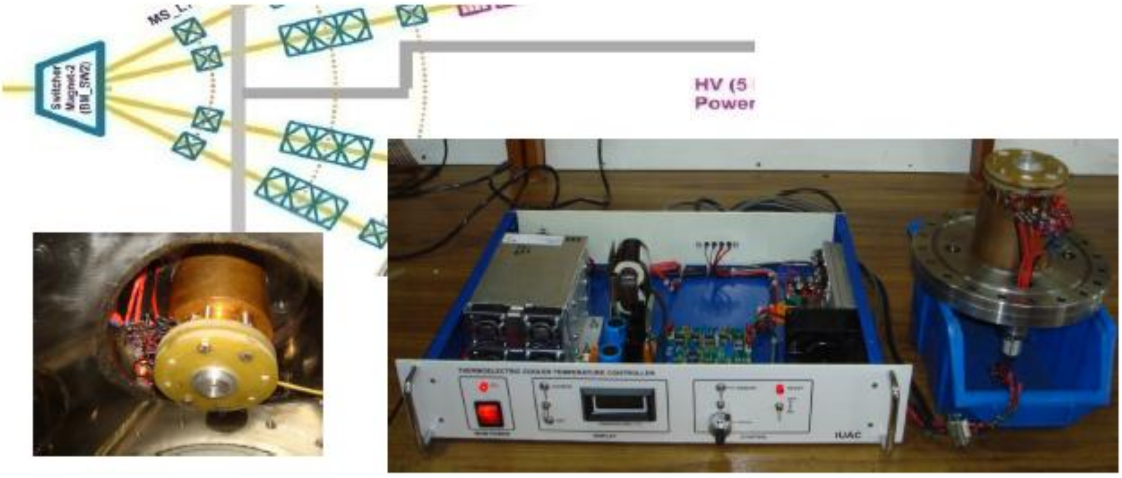
Facility wise Instrumentation development: INGA






INGA Experimental Facilities (2006-2008)				
	Description	Qty	Year	Status
1	NIM based 5kV/ 100uA low noise & low ripple HVPS with output ramping facility to bias Ge. Detectors	45	2008	In-operation
2	NIM based 3kV/ 10mA low noise & low ripple HVPS to bias ACS Detectors	40	2008	In-operation
3	±24V/1A, ±12/1A - Pre-Amplifier Power Supply	15	2008	In-operation

Facility wise Instrumentation development: Atomic Physics



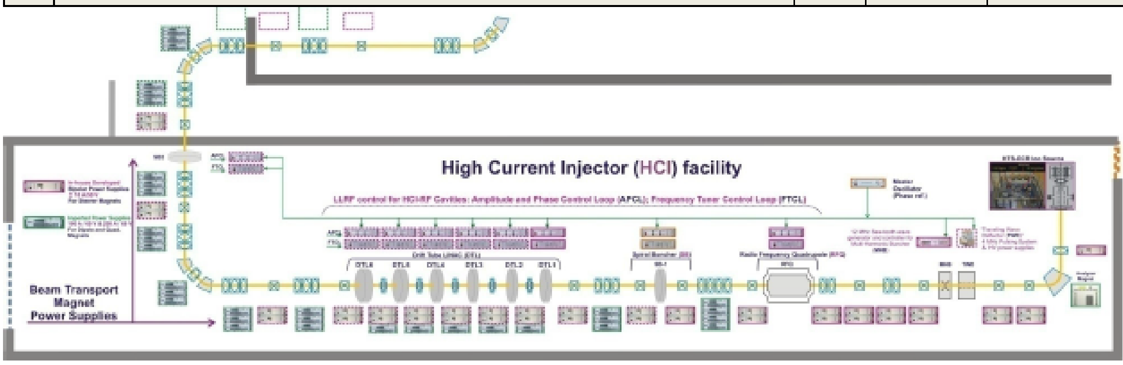
Atomic Physics Experimental Facility				
	Description	Qty	Year	Status
1	TEC (peltier) based Temp Controller (-25°C to100°C) To cool Si-surface barrier detector	01	2010	used

Facility wise Instrumentation development: HYRA

NAND Experimental Facilities (2006-10)				
	Description	Qty	Year	Status
1	High current (300A), high stability (10ppm) class Power supplies for HYRA spectrometer	05	2010	In-operation

Facility wise Instrumentation development: HCI

HCI Accelerator Facility (2006-2008)				
	Description	**Qty**	**Year**	**Status**
1	Bipolar Steerer Magnet (±5A/5A, 50PPM)	45	2015	In-Operation
2	LLRF based Amp. & Phase control for HCI-RF cavities	03	2016	In-Operation
3	LLRF based Frequency Tuner control HCI-RF cavities	01	2017	In-Operation
4	LLRF based12MHz saw tooth generator and controller for MHB	01	2017	In-Operation
5	LLRF based Master Oscillator Distribution unit	01	2018	In-Operation
6	High Freq, HV (4MHz/1kV- 4nos) Pulsars for HCI-TWD		In progress	In-Operation
7	HV supplies for ECR Extractor and Fast Faraday Cup	02	2018	In-Operation



Photographs: Instrument developed for: HCI








Facility wise Instrumentation development: LEIBF

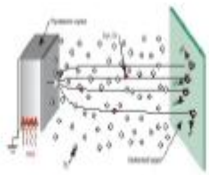
LEIBF Facility				
	Description	Qty	Year	Status
1	Bipolar current regulated Power Supply for Steerer Magnet (±5A/5A, 50PPM)	04	2010	In-Operation
2	Bipolar Triangular wave current regulated supply for High Field Scanning Magnet (±75A /±50V, 100Hz)	02	2010	In-Operation
3	Ultra fast (3 ns) HV switch To pulse low energy ion beam by applying HV pulse to a pair of sweeper plates	02	2010	In-Operation
4	3-Channel bipolar HV (±2kV) amplifier-A common instrument for electrostatic steerer, scanner & Quad.	01	2011	In-Operation

Photographs: Instrument developed for: LEIBF

Facility wise Instrumentation development:

Instrument Developed for research applications				
	Description	Qty	Year	Status
1	Spark Counter and controller: Alpha particle detection & counting-To study ionizing effect of radio activity.	02	2005	Tested and used
2	Electric Field vs Polarization (EP) Hysteresis loop tracer-compensate linear conductivity & stray capacitance.	01	2007	Tested and used
3	Electronic Instrumentation for the Development of Pyroelectric Crystal driven compact neutron source	01	2010	Could not be completed
4.	HV Power supply(3kV,200mA) for Saddle Field Fast Atom Beam Source	01	2010	Completed
5	Development of Magnet and associated Power Supply System for g - factor measurement set-up of nuclei.	01		

Photographs: Instrument developed for: Research application



B1. Development of 1.5 Tesla MRI Magnet

1.5 Tesla MRI

After fullfilling the primary responsibilities towards Accelerator, BTS group is involved in----

Responsibilities for the development of 1.5 T MRI magnet:

Design and Development of.....

A. Quench protection and detection Schemes

- Active protection
- Passive protection (Quench propagation)
- Noise immune quench detection (3-Point)

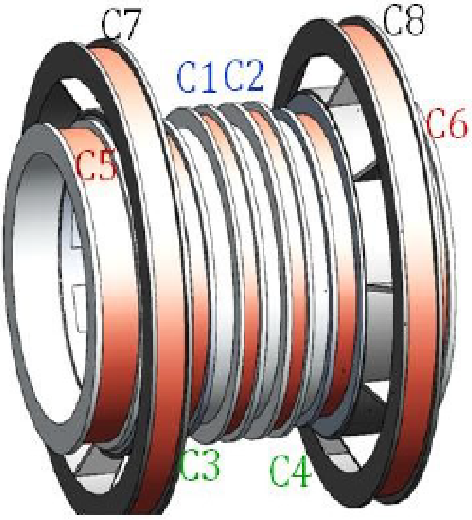
B. Development of required instrumentation

- Superconducting MPS @ 600A-10V (with Ramp control/Quench detection)
- Emergency Run Down Unit
- EIS-PCS Switch Heater Control
- MRI Cryostate Pressure control

C. Instrumentation set-up for testing of:

- High Power Quench protection diodes at 4K
- Superconducting Joints
- Superconducting persistent Switches

Stored Energy: 4.5MJ



Experiential learning

4.6. In all stages, experiential learning will be adopted, including hands-on learning, arts-integrated and sports-integrated education, story-telling-based pedagogy, among others, as standard pedagogy within each subject, and with explorations of relations among different subjects. To close the gap in achievement of learning outcomes, classroom transactions will shift, towards competency-based learning and education. The assessment tools (including assessment “as”, “of”, and “for” learning) will also be aligned with the learning outcomes, capabilities, and dispositions as specified for each subject of a given class.(NEP2020)

14.4.1. Steps to be taken by Governments (h) Develop and support technology tools for better participation and learning outcomes.(NEP2020)

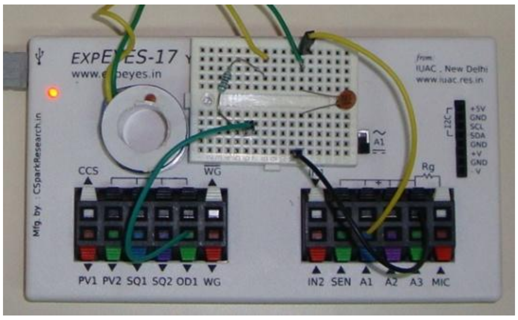
It should be noted that lack of such a curriculum and thus paucity of trained manpower poses challenges for maintenance and repair of expensive instruments leading to collapse of central workshops/ USIC in Universities.

Technology Use and Integration

23.1. India is a global leader in information and communication technology and in other cutting-edge domains, such as space. The Digital India Campaign is helping to transform the entire nation into a digitally empowered society and knowledge economy. While education will play a critical role in this transformation, technology itself will play an important role in the improvement of educational processes and outcomes; thus, the relationship between technology and education at all levels is bidirectional.

23.5. The thrust of technological interventions will be for the purposes of improving teaching learning and evaluation processes, supporting teacher preparation and professional development, enhancing educational access, and streamlining educational planning, management, and administration including processes related to admissions, attendance, assessments, etc.

Teaching lab Activities: As a part of IUAC's outreach programme, a project was started, named PHOENIX (Physics with Home-made Equipment and Innovative Experiments), with two major objectives; (1) Developing a computer interfaced device capable of performing the role of a number of laboratory equipments, (2) Training college/university teachers in its usage and development of new experiments. The device developed under this project provided a framework to design sophisticated science experiments without getting into the details of electronics or computer programming. It provided a set of ready-made experiments and also enabled teachers to design new experiments with improved precision, reliability and accuracy. Several revisions were done to the initial design over the years. The latest device is named ExpEYES (Experiments for Young Engineers and Scientists). The device is affordable even to an individual so that it enables the student to perform experiments outside the laboratory too. Introducing scientific computation using Python programming language also has been a part of this project. Over the years, it has been inducted into the syllabus of several Universities and a large number of institutions are using it as test equipment and for doing science and engineering projects.



Summary of programmes conducted since 2005:

1. Training programme at IUAC: Total 25 numbers, trained around 500 teachers

2. One Day Workshops at places all over India (100 numbers, 10,000 participants; teachers and students).

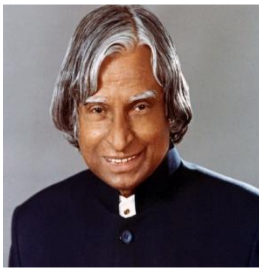
As the number of dedicated programme that could be conducted by IUAC is limited, the users were encouraged to train more people so that it reaches a larger community. As a result, this project has been presented at various national and international events, mostly by the teachers from various Universities and supported by the conference organizers.

3. Workshop, conference presentations & Publications:

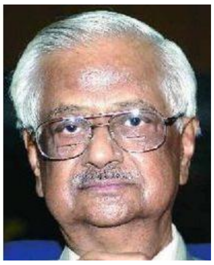
- Python in Science Experiments using Phoenix, Scipy.in 2010, Dec-2010, ISB, Hyderabad
- A Project for Practical Science Experiments, APEC ADOC2, Taipei, Oct-2010
- Workshop on expEYES, RMML 2012, July 2012, Geneva
- ExpEYES, a portable science laboratory, Scipy.in 2012 Conference, Dec-2012, IIT Bombay,
- ExpEYES, a portable science laboratory, FOSS.IN conference, Nov-2012, Bangalore
- Low cost PC with built-in Science Laboratory, RMML 2013, July 2013, Brussels
- An Open Source Portable Science Lab, FOSSASIA, Feb-2014, Phnom Penh City, Cambodia
- Sound Waves and Electromagnetic Induction with ExpEYES, RMML 2014, July 2014, France
- ExpEYES: Pocket Science Lab, FOSSASIA Summit, Mar-2016, Singapore
- Talk and workshop on ExpEYES, FOSSASIA-2017, Aug-2017, Singapore
- Innovative science experiments using Phoenix, 2009, IOP Phys. Educ. Journal 44469
- EM induction experiment to determine the moment of a magnet ,2014, IOP Phys. Educ. 49319
- Plugins for ExpEYES, project funding by Google Summer of Code 2014

FOUNDATION DAY - DECEMBER 19th
EMINENT SPEAKERS AT IUAC OVER THE YEARS


Prof. S. P. Pandya


Dr. A. P. J. Abdul Kalam

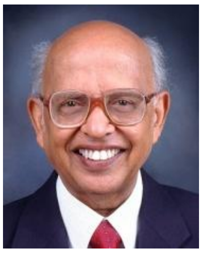

Prof. R. A. Mashelkar


Dr. Raja Ramanna


Prof. J. V. Narlikar


Dr. R. Chidambaram


Prof. K. Kasturirangan


Prof. G. Swarup

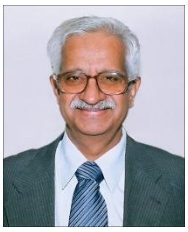

Prof. P. K. Kaw


Prof. S. K. Joshi


Prof. Goverdhan Mehta


Prof. G. Rajasekaran


Prof. Rohini Godbole


Prof. V. S. Ramamurthy


Prof. Asis Datta


Prof. C. N. R. Rao

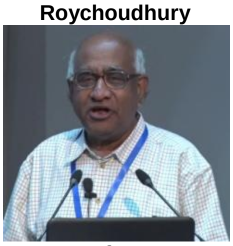

Prof. A.K. Roychoudhury

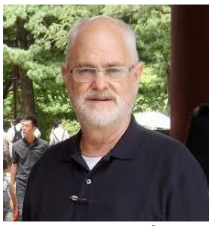

Prof. Bikash Sinha


Dr. Anil Kakodkar


Dr. Shailesh Nayak

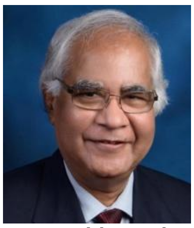

Prof. P. Rama Rao


Prof. T.V. Ramakrishnan


Dr. Jerry Nolen


Prof. Ashutosh Sharma

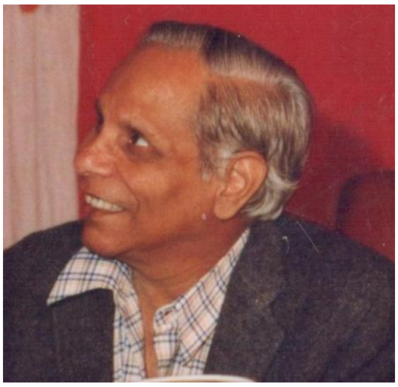

Dr. Sekhar Basu


Dr. Baldev Raj


Dr. Archana Sharma.


Prof. Annapurni Subramaniam

CENTRE DIRECTORS: PAST & PRESENT



Late Prof. A. P. Patro
(1984 – Oct. 1989)

Prof. G. K. Mehta
(Nov. 1989 – Mar. 2001)

Dr. Amit Roy
(Mar. 2001 – Jul. 2013)

Dr. D. Kanjilal
(Jul. 2013 – Jul 2018)

Prof. Avinash Chandra Pandey
(Aug. 2018 –)

LOCATION OF THE CENTRE

The Centre is situated 3.8 km from the old campus of Jawaharlal Nehru University, New Delhi. The JNU old campus is beside IIT-Delhi. The Centre is situated on the road going southwards from the old JNU campus. Starting from old JNU campus, the Centre is after JNU east gate, National Institute of Immunology (NII), Indian Institute of Mass Communication (IIMC), Indian Council of Social Science Research (ICSSR) and International Centre of Genetic Engineering & Biotechnology (ICGEB). Southwards of the Centre are Vasant Kunj (Sector B4, B-5/6), Kishangarh and Fortis Hospital, Vasant Kunj.

List of IUAC Users

List of University Users (163)

Agra University (B.R. Ambedkar Univ.), Agra, Uttar Pradesh
Alagappa University, Karaikudi, Tamil Nadu

Aligarh Muslim University, Aligarh, Uttar Pradesh
Allahabad University, Allahabad, Uttar Pradesh
Ambedkar University, New Delhi, Delhi
Amity University, Gurgaon, Haryana

Amity University, Noida, Uttar Pradesh

Amrita University, Bengaluru, Karnataka

Amrita VishwaVidhyapeetam, Coimbatore, Tamil Nadu

Andhra University, Visakhapatnam, Andhra Pradesh
Anna University, Chennai, Tamil Nadu
Annamalai University, Annamalainagar, Tamil Nadu

Assam University, Silchar, Assam
Baba Bhimrao Ambedkar University, Lucknow, Uttar Pradesh
Banaras Hindu University, Varanasi, Uttar Pradesh

Banasthali Vidyapith, Rajasthan

Bangalore University, Bengaluru, Karnataka
Barkatulla University, Bhopal, Madhya Pradesh
Berhampur University, Berhampur, Odisha
Bhagalpur University, Bhagalpur, Bihar
BhagatPhool Singh MahilaVishwavidyalaya, Khanpur Kalan Sonipat, Haryana
Bharathiar University, Coimbatore, Tamil Nadu

Bharthidasan University, Tiruchirappalli, Tamil Nadu

Bhavnagar University, Bhavnagar, Gujarat
Birla Institute of Technology, Mesra, Ranchi, Jharkhand

Bundelkhand University, Jhansi, Uttar Pradesh

Burdwan University, Burdwan, West Bengal
Calcutta Univesity, Kolkata, West Bengal

Calicut University, TrichyPalary, Malapuram, Kozhikode, Kerala

Central University of Jharkhand, Ranchi, Jharkhand

Central University of Himachal Pradesh, Himachal Pradesh

Central University of Gujarat, Gandhinagar, Gujarat

Central University of Haryana, Pali, Haryana

Central University of Karnataka, Gulbarga, Karnataka

Central University of Kashmir, Srinagar, Jammu and Kashmir

Central University of Kerala, Kasaragod, Kerala

Central University of Punjab, Bathinda, Punjab

Central University of Rajasthani, Ajmer District, Rajasthan

Central University of Tamil Nadu, Kangalancherry, Thiruvarur, Tamil Nadu

Chandrakona Vidyasagar Mahavidyalaya, Medinipur, Hisar, Haryana

Chatrapati Sahuji Maharaj Kanpur University, Kanpur, Uttar Pradesh

Chaudhary Charan Singh University, Meerut, Uttar Pradesh
Chaudhary Devi Lal University, Sirsa, Haryana
Chitkara University, Patiala, Punjab
Cochin University of Science & Technology, Cochin, Kerala

Crystal Growth Centre, Anna University, Chennai, Tamil Nadu

Ravenshaw University, Cuttack, Odisha
Deen Bandhu Chhotu Ram University of Science &Tech., Murthal, Haryana
Delhi Technical University, Delhi
Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh
DIT University, Dehradun, Uttarakhand

Doon University, Dehradun, Uttarakhand
Dr. Hari Singh Gaur Central University Sagar, Madhya Pradesh

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra

Dr.Ram Manohar Lohia Avadh University, Faizabad, Uttar Pradesh
Gobind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

Gauhati University, Guwahati, Assam

Gautam Buddha University, Greater Noida, Uttar Pradesh

Guru Govind Singh Inderaprastha University, Dwarka ,New Delhi,

GLA University, Mathura, Uttar Pradesh
Guru Nanak Dev University, Amritsar, Punjab
Goa University, Goa
Gorakhpur University, Gorakhpur, Uttar Pradesh

Gujarat University, Ahmedabad, Gujarat

Gulbarga University, Gulbarga, Karnataka

Guru Ghasidas Vishwavidyalaya, Bilaspur, Chattisgarh

Guru Jambeshwar University of Science and Technology, Hisar, Haryana
Hemwati Nandan Bahuguna Garhwal University, Garhwal, Uttarakhand

Harcourt Butler Technical University, Kanpur, UttarPradesh

Himachal Pradesh Technical University, Hamirpur, Himachal Pradesh
Himachal Pradesh University, Shimla, Himachal Pradesh
Indira Gandhi National Open University, New Delhi
Indira Gandhi University, Meerpur, Rewari,Haryana.
The North Cap University, Gurgaon, Haryana
The North Cap University, Gwalior, Madhya Pradesh
Jadavpur Univesity, Kolkata, West Bengal
Jai Prakash University, Chhapra, Bihar

Jaipur National University, Jaipur, Rajasthan

Jamia Milia Islamia University, New Delhi, Delhi

Jammu University, Jammu Tawi, Jammu and Kashmir
Jawaharlal Nehru Technological University, Anantpur, Andhra Pradesh

Jawaharlal Nehru University, New Delhi, Delhi
Jiwaji University, Gwalior, Madhya Pradesh
Kalyani University, Kalyani, West Bengal
Kannur University, Kannur, Kerala

Karanataka University, Dharwad, Karnataka

Kashmir University, Srinagar, Jammu and Kashmir

Kerala University, Thiruvananthapuram, Kerala
KIIT University, Bhubneswar, Odisha
Kolhan University, Chaibasa, West Singhbhum, Jharkhand
Kongunadu Arts & Science University, Coimbatore, Tamil Nadu

Kumaun University, Nainital, Uttrakhand

Kurukshetra University, Kurukshetra, Haryana
Lovely Professional University, Jalandhar, Punjab

Lucknow University, Lucknow, Uttar Pradesh
Maharishi Dayanand University, Rohtak, Haryana
Mahatma Jyotiba Phule Rohilkhand University, Bareilly, Uttar Pradesh
M. L Sukhadia University, Udaipur, Rajasthan

Maharaja Sayajirao University of Baroda, Vadodara, Gujarat
Madras University, Chennai, Tamil Nadu

Madurai Kamraj University, Madurai, Tamil Nadu
Magadh University, Bodh Gaya, Bihar
Maharaja Ranjit Singh Punjah Technical University, Bathinda, Punjab

Mahatama Gandhi University, Kottayam, Kerala

Manav Rachana International University, Faridabad, Haryana
Mangalore University, Mangalore, Karnataka

Manipur Univesity, Imphal, Manipur

Mannonmaniam Sundarnar University, Tirunelveli, Tamil Nadu
Mohanlal Sukhadia University, Udaipur, Rajasthan

Mother Teresa Women's University, Kodaikanal, Tamil Nadu

Mumbai University, Mumbai, Maharashtra
Mysore Univesrity, Mysore, Karnataka

Nagaland University, Ballard, Nagaland
Nagpur University, Nagpur, Maharashtra

Nirma University, Ahmedabad, Gujarat

North Eastern Hill Univerity, Shillong, Meghalaya

North Maharashtra University, Jalgaon, Maharashtra

North Orissa University, Baripada, Bhuabaneswar, Odisha

Osmania University, Hyderabad, Telangana
Punjabi University, Patiala, Punjab

Patna University, Patna, Bihar

Periyar University, Salem, Tamil Nadu

PES University, Bangalore, Karnataka
Petroliam University, Dehradun, Uttarakhand
Pondicherry University, Kalapet, Puducherry
Poona University, Pune, Maharashtra

Presidency University, Kolkata, West Bengal

Pandit Ravishankar Shukla University, Raipur, Chhattisgarh

Punjab Agricultural University, Ludhiana, Punjab

Punjab Technical University, Jalandhar,Punjab

Punjabi University, Patalia, Punjab

Punjab University, Chandigarh

Rajasthan University, Jaipur, Rajasthan

Ranchi University, Ranchi, Jharkhand

Rani Durgawati Vishwavidyalaya, Jabalpur, Madhya Pradesh

Sri Krishnadevaraya University, Anantpur, Andhra University

Sambalpur University, Sambalpur, Odisha

Sant Gadge Baba Amravati University, Amravati, Maharashtra

Saurashtra University, Rajkot, Gujarat

SavitribaiPhule Pune University, Pune, Maharashtra

Shiv Nadar University, Dabri, Uttar Pradesh

Shivaji University, Kolhapur, Maharashtra

Shri Mata Vaishno Devi University, Jammu, Jammu and Kashmir

Sikkim University, Gangtok, Sikkim

Solapur University, Solapur, Maharashtra

Sri Krishnadevaraya University, Anantapur, Andhra University

Sri Sathya Sai Institute of Higher Learning, PrasanthiNilayam, Andhra Pradesh

SRM University, Chennai, Tamil Nadu

Swami Ramanand Teerth Marathwada University, Nanded, Maharashtra

Tezpur Univesity, Tezpur, Assam

Thapar University, Patiala, Punjab

The Rashtrasant Tukadoji Maharaj Nagpur University, Maharashtra

Tumkur University, Tumkur, Karnataka

University of Delhi, New Delhi, Delhi

University of Hyderabad, Hyderabad, Telangana

University of Petroleum and Energy Studies, Dehradun, Uttarakhand

Utkal University, Bhubaneswar, Odisha

Uttar Pradesh Technical University, Lucknow, Uttar Pradesh

Vikram University, Ujjain, Madhya Pradesh

Visva Bharati, Shantiniketan, West Bengal

VIT University, Vellore, Tamil Nadu

West Bengal University of Technology, Kolkata, West Bengal

YMCA University of Science & Technology, Faridabad, Haryana

List of College Users at IUAC (86)

Acharya Narendra Dev College, New Delhi, Delhi

Aditya Degree College, Visakhapatnam, Andhra Pradesh

Anand Mohan College, Kolkata, West Bengal

Armed Forces Medical College, Pune, Maharashtra

Arya College, Panipat, Haryana

Bareilly College, Bareilly, Uttar Pradesh

Beant College of Engineering & Technology, Gurdaspur, Punjab

Belonia College, Belonia, Tripura

Bharatiya Jain Sanghatana College, Pune, Maharashtra

Bhiwandi College, Mumbai, Maharashtra

BNN College, Bhiwandi, Maharashtra

CHM College, Ulhasnagar, Maharashtra

Christ Church College, Bengaluru, Karnataka

College of Engineering and Technology, Aligarh, Uttar Pradesh

DAV College, Amritsar, Punjab

DAV College, Kanpur, Uttar Pradesh

DAV College, Mumbai, Maharashtra

Dayalbagh Educational College, Agra, Uttar Pradesh

DBS College, Dehradun, Uttarakhand

Doodhsakhar Mahavidyalaya, Bidri, Maharashtra

Egra S.S.B. College, Midnapore, West Bengal

Farook College, Kozhokode, Kerala

GKSM Govt. College, Hoshiarpur, Punjab

Government Arts College for Men, Chennai, Tamil Nadu

Government College, Hissar, Haryana

Government College, Malappuram, Kerala

Government Holkar Science college, Indore, Madhya Pradesh

Govt. Arts College, Rajamundry, Andhra Pradesh

Govt. College, Ajmer, Rajasthan

GovernmentCollege, Kota, Rajasthan

Govt. College, Mahendragarh, Haryana

Goyalpara College, Goyalpara, West Bengal

Gurudas College, Kolkata, West Bengal

Jai Hind College, Mumbai, Maharashtra

Jain College, Naziabad, Bijnor, Uttar Pradesh
K.K.Jain College, Meerut, Uttar Pradesh
K.K.PG College, Muzafanagar, Uttar Pradesh
Kongunadu Arts & Science College, Coimbatore, Tamil Nadu
Koshi College, Khagaria
M.L.N. College
M.M.H.College, Ghaziabad
Mahila Degree College, Lucknow
Malviya Regional Engg. College, Jaipur
Marwari College, Ranchi
Mithibhai College, Mumbai
MMH College, Ghaziabad
Moti Lal Nehru college, Delhi
MR College, Vizianagram
Mukund Lal National College, Kurukshetra
National P.G. College, Lucknow
Nayagarh College, Nayagarh
Nizam College, Hyderabad
Nowrosjee Wadia College, Pune
NSAM College, Mangalore
Orissa Univ. of Agriculture & Tech., Bhubneshwar
Poorna Prajna College, Udipi
Presidency College, Chennai
Punjab Engineering College, Chandigarh
R.B.S. College, Agra
RD & DJ College, Munger
Regional Engineering College, Kurukshetra
RPG College, Ratnagiri
S.N.College, Kollam

S.S.Jain Subodh PG College, Jaipur
St. Xavier's Collage, Kolkata, West Bengal
S.V. College, Aligarh
Salipur College, Cuttack
School of Physical Sciences, Nanded
School of Tech. & Applied Sciences, Kottayam
SDM College, Ujire, Mysore
Sharanabasaveshwar College of Science, Gulbarga
Shree Kerala Verma College, Thrissur
Sri Bhuvanendra College, Karkala
St. Aloysius College, Jabalpur
St. Edmunds College, Shillong
St. Stephen's College, Delhi
St. Thomas College, Lucknow
St. Thomas College, Thrissur
Swami Shardhanand College, New Delhi
Swami Sukhdevanand Post Graduate College, Lucknow
University College of Science & Tech., Kolkata
University College, Kurukshetra
Vaish College, Rohtak
Vardhman College, Bijnor,
Varshney College, Agra
Yadava college, Madurai

List of IIT /IISER/NISER Users at IUAC (16)

Indian Institute of Science, Bangalore
Indian Institute of Technology (ISM), Dhanbad
Indian Institute of Technology, Chennai
Indian Institute of Technology, Guwahati
Indian Institute of Technology, Kanpur
Indian Institute of Technology, Kharagpur
Indian Institute of Technology, Mandi
Indian Institute of Technology, Mumbai
Indian Institute of Technology, New Delhi
Indian Institute of Technology, Roorkee
Indian Institute of Technology, Ropar
Indian Institute of Technology, Srinagar
IISER, Kolkatta
IISER, Pune
NISER, Bhubaneswar
IISER, Mohali

List of NIT Users at IUAC (9)

Malviya National Institute of Technology Jaipur
Maulana Azad national Institute of Technology, Bhopal
National Institute of Oceonography
National Institute of Technology Calicut
National Institute of Technology Srinagar
National Institute of Technology, Hamirpur
National Institute of Technology, Jalandhar
National Institute of Technology, Kurukshetra
National Institute of Technology, Rourkela

List of Foreign Users at IUAC (45)

- ASUPAK, Taiwan
- Brookhaven National Laboratory (BNL),USA
- Centre for Superconductivity research, USA
- CSNSM, Orsay Cedex, France
- Flerov Laboratory of Nuclear Reaction, Russia
- Genetic Inst. of Manufacturing Technology, Singapore
- GSI, Germany
- H.I.L. Warsaw, Poland
- HIRS, Japan
- Indiana University,USA
- INFN-Legnaro National Laboratory, Italy
- INSH & FISCA, Brazil
- Institute of Electronics, Uzbekistan
- Institute of Sciences, Israel
- Japan Atomic Energy Agency, Vietnam
- Joint Inst. of Nuclear Research, Dubna, Russia
- Kiel University, Germany
- LNL, Italy
- Ludwig Maximillian University, Munich, Germany
- Massachusetts Inst. of Technology, USA
- Michigan State University (MSU),USA
- MMS, Japan
- N.V. University, USA
- Nanocrystals Technology, USA
- Nanyang Technological University, Singapore
- National Institute of Radiological Science, Chiba, Japan
- National University, Uzbekistan
- NCSR, France
- NEC,USA
- Nelson Mendela Africian Institute of Science, Tanzaina
- Oak Ridge National Laboratory, USA
- RIKEN, Japan
- St. Luciana University, USA
- Stuttgart University, Germany
- Syracuse University, New York, USA
- Technical University, Darmstadt, Germany
- The Joint Institute for Nuclear Research (JINR),Russia
- University of Huddersfield, UK
- University of Maryland, Maryland, USA
- University of North Taxes, USA
- University of Notre Dame, Notre Dame, USA
- University of Saskatchewan, Canada
- University of Chicago, Chicago USA
- Wroglow University of Tech, Poland
- Vienna University, Austria

List of Research Institute users at IUAC (37)

- Bhabha Atomic Research Centre, Mumbai
- C.E.E.R.I., Pilani
- CCMB, Hyderabad
- D.M.R.L., Hyderabad
- Defence Laboratory, Jodhpur
- Defence Research & Development Orgn., Dehradun
- Harish Chandra Research Institute, Allahabad
- I.G.C.A.R., Kalpakkam
- Indian Association for the Cultivation of Science, Kolkata
- Indian Institute of Space Science and Technology , IIST Thiruvananthapuram
- Indian Space Research Organisation, Bangalore
- INMAS, New Delhi
- Institute of Basic Sciences, Agra
- Institute of Materials Science, Bhubaneswar
- Institute of Mineral & Materials Technology, Bhubneshwar
- Institute of Physics, Bhubaneswar
- Institute of Plasma Resarch, Ahmedabad
- Institute of Science, Mumbai
- ISCO, Bangalore
- IUC-DAEF, Calcutta Centre, Kolkata
- IUC-DAEF, Indore Centre, Indore
- J.C.Bose Institute, Kolkata
- Marveric Technology in Guwahati
- National Academy of Science, Allahabad
- National Physical Laboratory, New Delhi
- NCCCM/BARC, Hyderabad
- NISS, Bangalore
- Physical Research of Laboratory, Ahmedabad
- Raman Research Institute, Bangalore
- RRCAT, Indore
- Saha Institute of Nuclear Physics, Kolkata
- Sant Longowal Institute of Engineering & Technology, Sangrur
- SSPL, New Delhi
- Tata Institute of Fundamental Research, Mumbai
- Thapar Inst. Of Eng. & Technology, Patiala
- VECC, Kolkata
- Wadia Institute of Himalayan Geology, Dehradun

1984

1985

1986

1987

1988

1989

Early Years of NUCLEAR SCIENCE CENTRE,

which was renamed in June 2005 as INTER-UNIVERSITY ACCELERATOR CENTRE

अन्तर विश्वविद्यालय त्वरक केन्द्र

Inter-University Accelerator Centre

(विश्वविद्यालय अनुदान आयोग का स्वायत अनुसंधान केन्द्र)

(An Autonomous Inter-University Centre of UGC)

Post Box : 10502, Aruna Asaf Ali Marg, New Delhi - 110 067
Phone: 91-11-26893955, 26892601, 26892603; FAX: 91-11-26893666;
website: www.iuac.res.in;https://youtu.be/69QvdUssk0s