Argonne NATIONAL LABORATORY

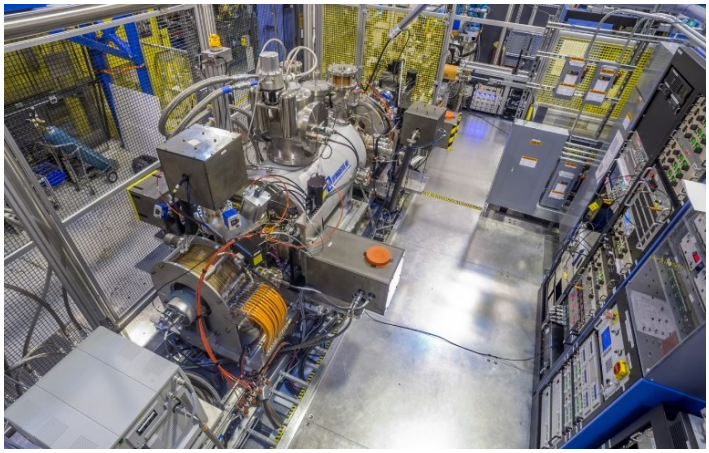
ATLAS

Argonne Tandem Linear Accelerator System

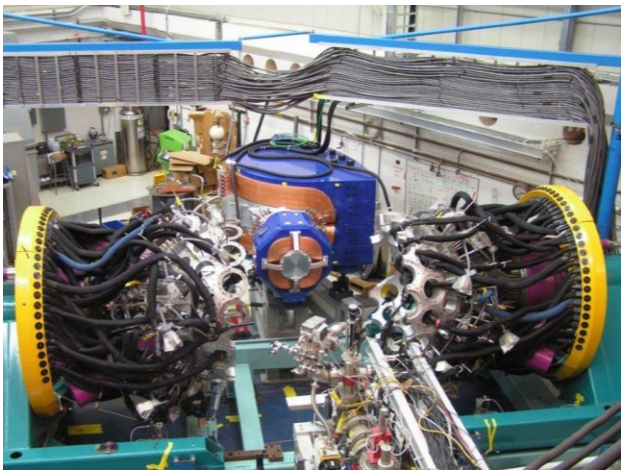
The DOE low-energy nuclear physics national user facility

ATLAS:

The ATLAS facility is the US DOE national user facility for nuclear physics research at low energies. These energies, in the vicinity of the Coulomb barrier, cover the energy domain where nuclear reactions occur in the cosmos. ATLAS provides a wide range of beams for nuclear reaction and structure research to a large community of users from the US and abroad. The full range of all stable ions can be produced, accelerated in the world's first superconducting linear accelerator for ions to energies of 10-20 MeV per nucleon and delivered to one of several target stations. The facility was enhanced a few years ago with the Californium Rare Isotope Breeder Upgrade (CARIBU) which allows it to also produce world-unique beams of neutron-rich rare isotopes of interest to nuclear astrophysics and societal applications such as next generation nuclear reactors and nuclear forensics.



The EBIS ion source used to increase the charge-state of the rare neutron-rich isotopes obtained from the CARIBU facility for acceleration through the ATLAS linac.



The GAMMASPHERE germanium detector array located at the focal plane of the newly commissioned AGFA gas-filled spectrometer.

Research programs:

The ATLAS research programs focus on the key questions that are central to our understanding of matter and on the description of the astrophysical processes that generate energy and produce elements in the stars. These areas of research have been endorsed in several major reviews of the science. Specific issues being addressed include 1) the quantum shell structure of nuclei, 2) the evolution of nuclear structure as a function of neutron excess, 3) exotic decay modes, 4) masses of exotic nuclei, 5) fundamental symmetries, 6) nuclear reactions of astrophysical importance, 7) properties of the heaviest nuclei and 8) applications of nuclear science.

ATLAS hosts a number of unique state-of-the-art instruments to perform this research efficiently. They include devices developed at ATLAS and devices built by ATLAS users that are stationed at the facility to take advantage of the unique beams ATLAS can provide.

Accelerator R&D:

The ATLAS accelerator has been regularly upgraded to remain at the forefront of accelerator technology. The accelerator R&D group hosted in the Physics Division at Argonne National Laboratory is a world leader in the fabrication and operation of superconducting cavities. New cavities developed for recent ATLAS upgrades hold the record for the highest acceleration voltages in that velocity regime. The expertise of this group is in high demand by other facilities and agencies to develop cavities suited to their particular needs.

A string of superconducting cavities and focusing solenoids developed for a recent intensity upgrade of the ATLAS facility.

Operation and on-going facility upgrades

The ATLAS facility delivers about 6000 hours of beamtime to its users per year with high reliability. It is heavily oversubscribed and an external Program Advisory Committee provides advice on which of the proposed experiments can make best use of the facility and provides the most interesting science within the beamtime available. A proposed upgrade of the facility, the ATLAS Multi-User Upgrade, would allow the delivery of beam to more than one experiment at a time, significantly increasing the effective number of beamtime hours delivered and allowing the facility to accept more of the experiments proposed by the scientific community.

In addition, new capabilities are being added to gain access to a new region of rare isotopes which have escaped detection so far. These new isotopes, mostly very neutron-rich isotopes of the heavier elements, are critical to our understanding of the formation of the heavy elements in the cosmos. However, the reaction mechanisms typically used in existing facilities do not produce them in sufficient amounts to enable their study. A new reaction mechanism, coupled to the techniques developed at ATLAS for the CARIBU facility, will allow these new isotopes to be produced and separated with sufficient intensity to enable first studies of the properties of these critical isotopes. This upgrade, the so-called N=126 factory named after the neutron number of the isotopes of interest, will be implemented within the existing budget envelope. The ATLAS Multi-User Upgrade mentioned above requires a slight increase in the operating personnel to deal with the added complexity of running multiple experiments at the same time.

Contact

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