Alternating Gradient Synchrotron Complex

Home to a Scientific Workhorse

Purpose:
To provide intense beams of protons and heavy ions for experiments in high energy and nuclear physics, in support of the NASA radiobiology program, and for the production of radioisotopes for biomedical research.

Sponsor:
U.S. Department of Energy's Offices Of High Energy and Nuclear Physics, the Office of Nuclear Science and Technology, and NASA.

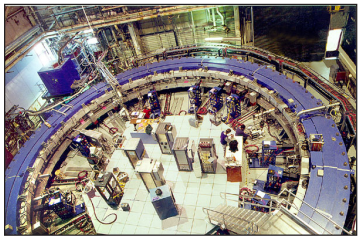
Operating Costs:
$7 million per year

Features:
- World's most intense, high-energy proton beam
- Capable of accelerating heavy ions such as iron and gold up to 11 giga-electron volts per atomic mass unit
- Serves as injector to the Relativistic Heavy Ion Collider (RHIC)
- Auxiliary facilities: the 200 million-electron-volt LINAC and the Booster Application Facility

Users:
More than 400 users from 100 national and international institutions

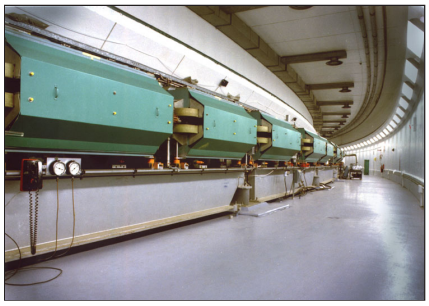
Complementary Facilities:
FERMI National Laboratory
CERN

www.bnl.gov/bnlweb/facilities/AGS.html



The g-2 experiment at the AGS.

Since 1960, the Alternating Gradient Synchrotron (AGS) has been one of the world's premiere particle accelerators, best known for the three Nobel Prizes awarded as a result of research performed there. It is has now taken on an expanded role as the injector for Brookhaven's Relativistic Heavy Ion Collider (RHIC), the world's newest and biggest accelerator for studies in nuclear physics.



The AGS's 240 magnets are housed in an underground ring.

The AGS accelerator complex includes the AGS itself, the Tandem Van Der Graaff accelerator, the LINAC, and the Booster. The 843-foot-diameter AGS accelerates protons and heavy ions. It produces the world's highest intensity high-energy proton beam and boasts the world's largest superconducting magnet, part of the muon g-2 experiment.

What's in a Name

The AGS's name is derived from the concept of alternating gradient focusing, in which the field gradients of the accelerator's 240 magnets are successively alternated inward and outward, permitting particles to be propelled and focused in both the horizontal and vertical plane at the same time. Capable of accelerating 75 trillion protons with every pulse, and heavy ions such as gold and iron, the AGS is used each year by 400 researchers representing 100 institutions from around the world.

The AGS receives protons from Brookhaven's 200 million-electron-volt (MeV) linear accelerator (LINAC). The Booster, constructed in 1991, further augmented the capabilities of the AGS, enabling it to accelerate many more protons and all species of heavy ions than before.

In addition, the complex's 200-MeV LINAC supports the Brookhaven Linac Isotope Producer, which is used for the production of medical isotopes. The complex is also home to the Booster Application Facility, a beam line and experimental facility funded by NASA that takes advantage of the heavy-ion beams delivered from the Booster. The NASA-sponsored researchers are focusing on the radiobiological effects that might be associated with deep space travel. The AGS also delivers ion and proton beams for other programs supported by NASA.

Future Direction

For 40 years, the AGS has been the "workhorse" for research in high-energy physics, research that has lead to a deeper understanding of the fundamental nature of matter. The AGS is the centerpiece of a complex of machines that provides beams for experiments of exceptional scientific merit as determined by Brookhaven and funded by the Department of Energy Office of High Energy and Nuclear Physics.

As the AGS continues its long-term role as injector for RHIC it also will continue to be the world's best facility for exploration of very rare phenomena in particle physics because of the exceptional intensity of its high-energy proton beams. The AGS will be home to experiments investigating Rare Symmetry Violating Processes, a project to be sponsored by the National Science Foundation. Other important research involving pion, kaon and muon beams is also planned.

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