Purpose:

To support nuclear physics research at the Relativistic Heavy Ion Collider (RHIC), radiobiology at the NASA Space Radiation Laboratory, and provide reimbursed services to a large community of industrial and technological users

Sponsor:

- U.S. Department of Energy Office of Nuclear Physics
- NASA

Funding:

The use as a RHIC injector is funded by DOE's Office of Nuclear Physics as part of the RHIC complex.

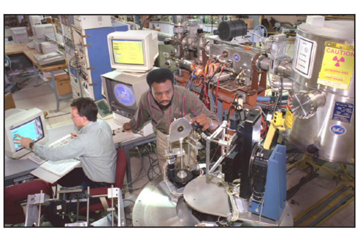
The services for industrial and space applications are provided on a full cost-recovery basis.

Features:

- Many different ion species
- Wide range of energies
- Wide range of intensities
- High beam quality
- Accurately known beam characteristics
- Reliable operation
- User friendly environment

Users:

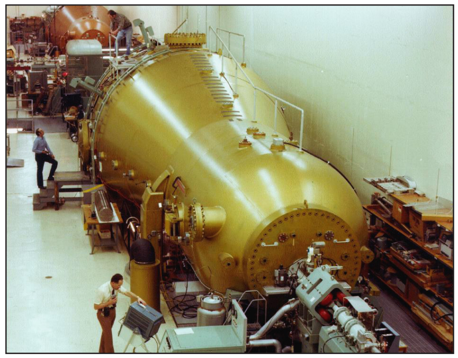
- 55 U.S. companies, 9 universities, 8 agencies and laboratories, and NASA
- 8 European companies, the French AEC, and the European Space Agency
- 4 Japanese corporations and the Japanese Space Agency



Testing the radiation hardness of microchips at BNL's Tandem Van de Graaff facility

The Brookhaven Tandem Van de Graaff Facility

Ions for science and technology



BNL's Tandem Van de Graaff accelerators

Two large electrostatic Tandem Van de Graaff accelerators are part of the Relativistic Heavy Ion Collider and NASA Space Radiation Laboratory complex, injecting beams of ions into other accelerators for studies of the fundamental components of matter and their interactions and the effects of simulated space radiation. They also provide a large variety of ion beams to a community of high tech industrial and space applications users on a cost-recovery basis. Thus valuable services are provided while maintaining good operational continuity and adequate staffing levels.

The ion species available range from protons to gold, and the energies and intensities can be accurately controlled and continuously varied over many orders of magnitude. This unusual versatility results in applications that would otherwise be impossible or inconvenient.

Two main user applications of beams produced in the Tandems are the testing of critical space related hardware and the fabrication of ultra small-pore filter materials.

Simulated space radiation

Computers in space, and other instrument components, are susceptible to radiation damage and transient errors due to the impact of energetic ions — which do not reach us on Earth, where we are protected by the Earth's atmosphere and magnetic field. The susceptibility of microchips to radiation has increased over the years as the size of the features shrinks to achieve increased computer power at reduced cost, weight, and power consumption.

The ions provided at the Brookhaven Tandem Facility enable users to test the radiation hardness of microchips and other materials under a wide variety of well-controlled conditions, which is essential for a detailed understanding and mitigation of the failures. For example, NASA used these beams to test some components of the Mars Rovers, one of which continues exploring that planet's surface today after landing seven years ago.

Making very fine filters

There is only one method for fabricating filter materials with very uniform pores down to 50 nanometers, or billionths of a meter, in diameter. Thin plastic films are irradiated with energetic heavy ions, and pores are developed later through preferential etching along the radiation-damaged tracks left behind by the ions.

The irradiation part of this procedure is carried out at the Brookhaven Tandem Facility in a unique irradiation chamber owned by the General Electric Corporation. There are very few similar facilities worldwide.

Alternative (but much less appealing) sources of ions used for this purpose are fission products produced inside a nuclear reactor. By using a particle accelerator such as the Tandem, material activation problems are avoided, parallel pores can be generated, and there is control over the ion species and energy, leading to better quality and wider range of products.

These fine-pore filters are used by the semiconductor industry to obtain particle-free water for rinsing silicon wafers; in medical and biological studies to separate microbes, viruses, and cells; and in other applications including filtration in the wine and beer industries.

(03-11)