RESEARCH FACILITIES AND PROGRAMS

Nuclear structure at BNL

Facilities for nuclear structure research at Brookhaven National Laboratory are being expanded. The existing 60-inch cyclotron will be converted into a spiral-ridge machine with variable energy, and two Model MP Tandem Van de Graaff accelerators will be constructed there by High Voltage Engineering Corporation. The machines are intended to supplement current university facilities by providing increased energy capability and high-energy resolution.

Modifications for the 60-inch cyclotron are already in progress, and the installation is expected to be finished by September 1966. The energy will be smoothly variable by a factor of ten. The maximum energies of the cyclotron will be 40 MeV for protons and ^{4}He particles 20 MeV for deuterons, and 60 MeV for ^{3}He particles. External beam currents of thirty to fifty microamperes with an energy spread of fifty to seventy keV are expected. It will also be possible to accelerate various heavy ions to energies approaching 100 MeV. A switching magnet and multiple-beampipe arrangement will be installed to extend the availability of experimental stations; a small on-line computer will be available for multiparameter experiments involving several particles in coincidence.

The two tandem Van de Graaff machines will be installed in a new building especially designed for them, and will be able to operate separately, each as a two-stage 20-MeV machine, or else as a single three-stage 30-MeV accelerator with the first machine acting as an injector for the second machine. The injection will be done by operating the first machine with a terminal ion source.

The three-stage beam will be switched into any one of three different rooms by a $\pm$70-degree switching magnet, and the rooms may be used independently so that experimental equipment may be installed and tested in two of the rooms while the other is being used for research. The maximum energy will be 30 MeV for three-stage operation with protons, deuterons, or tritons, and 40 MeV for ^{3}He and ^{4}He ions when negative He ions are available. The energy spread is expected to be + 2 keV and the maximum beam current to be ten microamperes. It will also be possible to accelerate heavy ions to several hundred MeV.

It is expected that the machines will be operational as two-stage tandem Van de Graaff accelerators by the spring of 1968. The terminal source and three-stage operation are expected to be ready for research within a year after final acceptance tests for the two standard machines.

A single-gap high-resolution magnetic spectrometer is also planned for the facility in order to take advantage of the high-energy-resolution capability of the three-stage operation. Most of the experimental apparatus in use at either the cyclotron or the Van de Graaffs will be readily exchangeable from one machine to the other. Since the cyclotron and Van de Graaff buildings will adjoin, it will be possible in the future to inject the cyclotron beam into the tandem accelerator or vice persa, if desired.

10-BeV electrons at Cornell

The world's largest electron synchrotron—10 BeV, will be built at Cornell University with a grant of $11.3 million from the National Science Foundation. This is the largest single grant ever given by NSF to a university. Construction is scheduled to begin immediately and expected to take two or three years.

At present the largest electron synchrotrons are the Cambridge Electron Accelerator in the United States, and DESY in Hamburg. Both machines have peak energies of about 6 BeV and may be capable eventually of 7 or 8 BeV. The Cornell machine is designed for 10 BeV and may eventually give 15 BeV.

It will be a strong-focusing machine, taking 250 MeV electrons from a linear accelerator, and injecting them into a ring tunnel whose orbit radius will be about four hundred feet. There will be six straight sections separating the 96 magnets which alternately focus and defocus the electrons.

The magnets will be very small, 11½" by 8" in cross section. The magnetic field will be rather low, about five kilogauss, because of the large orbit radius. The machine will have no vacuum doughnut in the gap; instead the magnet will be covered on the outside by a stainless steel sheath. The accelerator is expected to produce 10^{11} electrons per pulse with a repetition rate of sixty cycles per second.

Cornell's Laboratory of Nuclear Studies is directed by Robert R. Wilson.

CERN rf separator

A radiofrequency beam separator, which produces a beam of 10-BeV/*c* negative kaons, is now operating at CERN in conjunction with the 28-BeV proton synchrotron. The new installation is the first to use radiofrequency electromagnetic fields as a method of separating beams at such high energies. A separator of the same type is under construction at Brookhaven, and related types are being built at Dubna, Stanford, and Orsay.

The simplest kind of particle separator is electrostatic, but it is only convenient for particles with relatively low energy. As the energy is increased, very high voltages are needed to get a reasonable separation between particles; also, as the energy is increased the difference in velocities produced by the electrostatic field becomes smaller due to the relativity effect. At CERN, for example, in order to produce electrostatically a reasonably pure beam of kaons with 6 BeV/*c* momentum, the beam line was 180 m long, and contained some forty separate components, including