

beam lines, the building and plant associated with the operation of the accelerator and initial equipment for the experimental program. Although Daresbury is constructing the machine itself, it is letting various external contracts. In addition Daresbury and High Voltage have agreed that High Voltage will handle the laddertron device commercially outside the United Kingdom.

It is expected that the Daresbury facility will support about 80 users, mainly from universities in the UK, although requests for machine time from abroad are expected to be large, too.

In March 1971 a design study was authorized, under the direction of Voss. It was plain that there would be a great deal of difficulty in maintaining the high voltage required. Daresbury had already built a 5.3-GeV electron synchrotron and thereby acquired a background of accelerator expertise. Voss told us that it soon became clear to them that "in the field of electrostatic accelerators much of the design was based on tradition and on rather shaky scientific and technical data." So they launched a sizable research and development effort on electrostatic accelerators. They have tried, in designing the machine, to make it as flexible as possible. It is designed so that a second accelerator can be added at a later date, such as a linac or cyclotron. In the planned experimental program, particular emphasis is being placed on heavy ions.

Because of opposition from residents of two nearby villages, who were concerned about the height of the tower, a public inquiry was held last July by an inspector of the Department of the Environment. Subsequently, in December, the department granted approval. Then in January came the go-ahead from the Science Research Council.

Daresbury's nearest competitor in voltage will be at the Oak Ridge heavy-ion facility (see page 20), which was recently included in the Presidential budget; it calls for the purchase of a 25-MV tandem electrostatic accelerator.

At present High Voltage Engineering Corp has operated its TU test machine at Burlington, Mass. to accelerate a 0.5-microamp analyzed proton beam with 16 MV on terminal, O^{6+} with 14 MV on terminal yielding 0.23 microamp analyzed beam and I^{6+} with 13 MV on terminal yielding 0.13 microamp analyzed beam. Meanwhile National Electrostatics Corp has installed a 14-MV Pelletron at the Australian National University in Canberra; it has just passed its acceptance tests and is expected to be doing research shortly. The machine has accelerated protons with 14 MV on terminal yielding a 3-microamp analyzed

beam and Cl^{8+} with 14 MV on terminal yielding 0.20 microamp analyzed beam. A second 14-MV Pelletron has been purchased for the Weizmann Institute in Rehovoth, Israel. A smaller Pelletron (8-9 MV) is operating at Sao Paulo University in Brazil.

The Model MP Van de Graaffs built by High Voltage are being upgraded with new acceleration tubes that are expected to raise their voltages from 10-11 MV to 13 MV and above. Brookhaven has run one of its MPs at 12 MV, Heidelberg is running at 13 MV, Chalk River has run at 13 MV, and Yale hopes to run at 15 MV. Meanwhile some of the MP tandem facilities are installing Pelletron charging devices instead of the original charging belts supplied by High Voltage. Yale already has had one operating for some time, Chalk River is installing one now, and Heidelberg and Munich are planning to install them next fall.

—GBL

AEC requests funds for heavy-ion accelerators

Initial funding for a large tandem electrostatic accelerator at Oak Ridge appears in the FY 1975 AEC budget request. Also included in the \$19.2-million request is money for expansion and upgrading of SuperHILAC at Lawrence Berkeley Laboratory.

Oak Ridge Accelerator. The new 25-MV heavy-ion accelerator can be used alone or in conjunction with the extant Oak Ridge Isochronous Cyclotron (ORIC) as an intermediate energy "booster" and will serve to expand the US capability in heavy-ion research. The Oak Ridge proposal is a modification of one of three presented for consideration two years ago—Argonne and Los Alamos had also submitted proposals (PHYSICS TODAY, July 1972, page 18).

The tandem accelerator will be a vertical machine, housed in a tower 48 feet in diameter, 200 feet high and located adjacent to the present cyclotron building. Money is included in the AEC request for construction of the tandem accelerator itself, for cyclotron modifications, for the accelerator tower and for additional experimental and control-room areas. The facility is scheduled for completion in four years. Two companies, National Electrostatics Corp and High Voltage Engineering Corp, are expected to bid for the accelerator construction contract.

The tandem + ORIC combination will provide variable energy, high-resolution beams of ions well into the medium-mass region. The new accelerator alone will accelerate ions to 2-2.5 MeV/nucleon for ions of mass 200 to 238 and approximately 8.5 MeV/nucleon

for ions around mass 40. This performance is for the most abundant charge state from a gas stripper in the terminal and a foil stripper two-fifths of the way down the high-energy column. With ORIC used as a post-accelerator, there is a considerable increase in the available energy. A good indication of this is the heaviest ion that can be accelerated above the Coulomb barrier of Pb^{208} . The tandem alone will be able to accelerate ions of mass less than 90 to energies above the lead Coulomb barrier; the tandem + ORIC combination extends this capability up to ions of mass 140. In both cases these limits can be raised with a more reliable foil stripper in the tandem accelerator or with a lower beam intensity.

The facility will be suited for precise nuclear-structure and reaction studies requiring high-resolution measurements as well as to a wide spectrum of research interests in nuclear, atomic and solid-state physics, nuclear chemistry and materials science. J. B. Ball will be project director for the heavy-ion facility with J. A. Martin serving as deputy project director.

SuperHILAC expansion. The work to upgrade the heavy-ion facilities at LBL is designed to make SuperHILAC a national facility for heavy-ion research by serving outside user groups more fully. Modifications to the accelerator, building a monitoring and control system to improve machine reliability and stability and installation of new beam lines and associated equipment will allow more experiments to be carried out at one time.

The construction project is underway for Bevalac (a combination of SuperHILAC and the Bevatron synchrotron). Included in the project is funding to power a fifth section of SuperHILAC, which will raise it from its present capability of 7.2 MeV/nucleon (for mass 40 to mass 238) to 8.5 MeV/nucleon. When the 8.5-MeV/nucleon SuperHILAC beam is accelerated into the Bevatron, the energy per nucleon is expected to reach 2.5 GeV, thus providing the highest energy heavy ions available in the world. SuperHILAC alone and the proposed Oak Ridge tandem + ORIC are, by way of contrast, low-energy facilities.

Heavy-ion beams resulting from the Bevalac project are expected to be ready for testing and evaluation in July or August with experiments to begin in October or November. A time-sharing system involving the SuperHILAC and the Bevalac is planned for operation in March 1975. Pulses will be shared from the SuperHILAC to allow simultaneous experiments at SuperHILAC and the Bevatron. The full Bevalac construction project is slated for completion in July 1975.

—RAS □