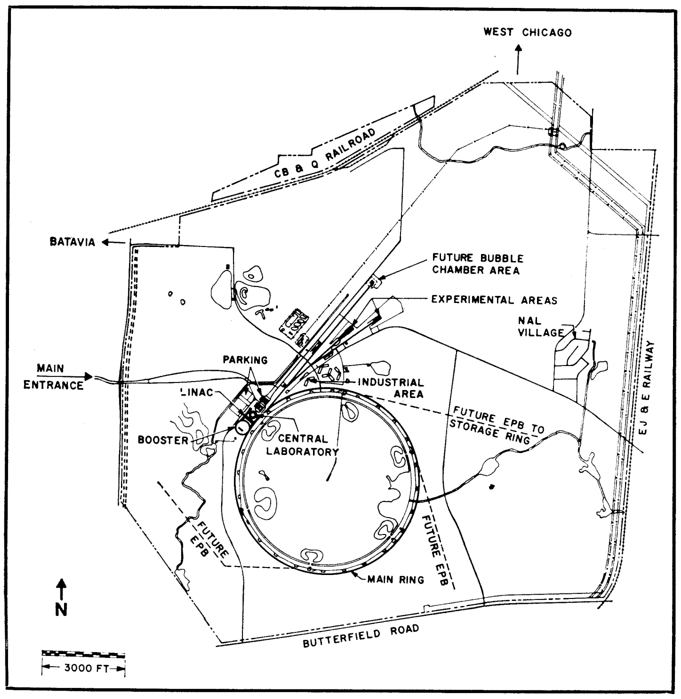
More power sooner for Batavia

Improved technology will permit limited experimentation at 500 GeV in 1972



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NAL: 500–GeV protons expected from the beginning.

The history of atomic, nuclear and particle physics has been characterized by a continuing attempt to study ever smaller structures with ever more energetic probes. In order to attain the goals, physicists have had to build more and more energetic particle accelerators.

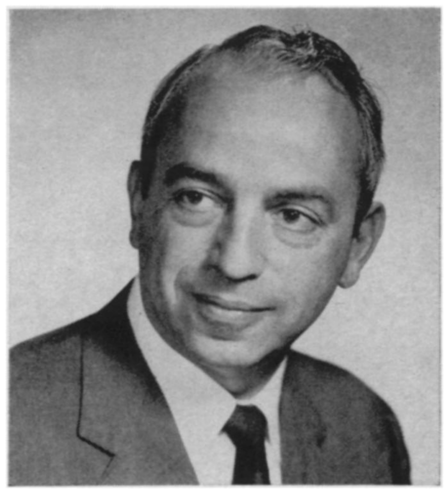
American physicists are now constructing an accelerator for the energy range of hundreds of billions of electron volts at the National Accelerator Laboratory at Batavia, Ill. They are finding that recent technological developments are enabling them to surpass their original plan for a first stage of 200 billion electron volts (GeV) and a later increase to 400 GeV. They say now that they will begin with a beam of 500-GeV protons about a year from now, making possible physical experiments at this energy several years before they were anticipated in the original plans.

The first plan for the Batavia machine was to build a proton accelerator with a maximum energy of 200 GeV. By the time construction began in 1969 advances in technology had permitted a redesign of the accelerator so that it would begin with a maximum energy of 200 GeV and after a few years of operation at that level could have its energy increased to 400 GeV. By spring of this year tests of the magnets delivered for the accelerator showed that they could stand stronger fields than they had been designed for and that it was possible to make the accelerator's maximum energy 500 GeV.

Now it also turns out that the technology of thyristors, solid-state switching and rectifying elements used in the electrical power supply circuits, has progressed so far since the circuits were designed that the thyristors being delivered for the accelerator can take twice the currents they were originally rated for. Therefore, the accelerator can start out with a 500 GeV beam right from the beginning.

Because other elements in the planning have not kept pace, initial operation at 500-GeV energy will be a sometime thing. "Only now and then at 3 a.m.," says Donald R. Getz, assistant director of the National Accelerator Laboratory. "We're still negotiating with Commonwealth Edison; we take a lot of power from their lines. We couldn't do this on a hot summer afternoon."

The initial operation at 500 GeV will also be at a lower intensity (fewer accelerated particles per minute) than is provided for in the ultimate plan. The water cooling system that removes heat from the electrical elements is not sufficient for continued high-intensity operation at the maximum energy, says Dr. Edwin L. Goldwasser, associate director of the laboratory. The system as it stands was designed for an initial operation at 200 GeV. Therefore, says Dr. Goldwasser, instead of running the accelerator at one pulse every four or eight seconds, it will have to be slowed to about a pulse every minute to operate at 500 GeV. This means that such experiments will go slowly at first.



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Goldwasser: 85 proposals to consider.

Later on, he says, if the maximum energy beam works out properly, "we can beef up the cooling power."

The accelerator's first beam of protons is expected about a year from now, says Dr. Goldwasser—a year in advance of the original 1972 target date. Actual experimentation should begin sometime in 1972.

The laboratory is now engaged in sorting through experimental proposals, and a committee meeting this week is expected to come up with some kind of tentative program. In the past, summer study groups have discussed what sort of things the accelerator might do. But this, says Dr. Goldwasser, is the first time it has invited "real proposals from real physicists."

The committee is now sifting 85 such definite proposals. The proposals were being drawn up at the same time that the technological advances were becoming apparent, but some of them, says Getz, are written in the expectation of having 500-GeV beams available. Others can be done with 200-GeV beams, the level at which the accelerator will do most of its running in the early days.

Many of the proposals now before the laboratory management propose to search for particles that theorists feel are necessary to the success of various theories but which so far have not been found by experimenters. These include the so-called quarks, particles of which all the other particles are supposed to be built (SN: 9/13, p. 198).

Another theoretically desirable particle is the so-called intermediate vector boson or W particle (SN: 11/16/68, p. 500). This particle is important to certain theories of how the weak subnuclear force behaves. Another particle to be sought is the so-called magnetic monopole, an object that would have either a north magnetic or a south magnetic pole standing alone, unlike any other known magnetic body.

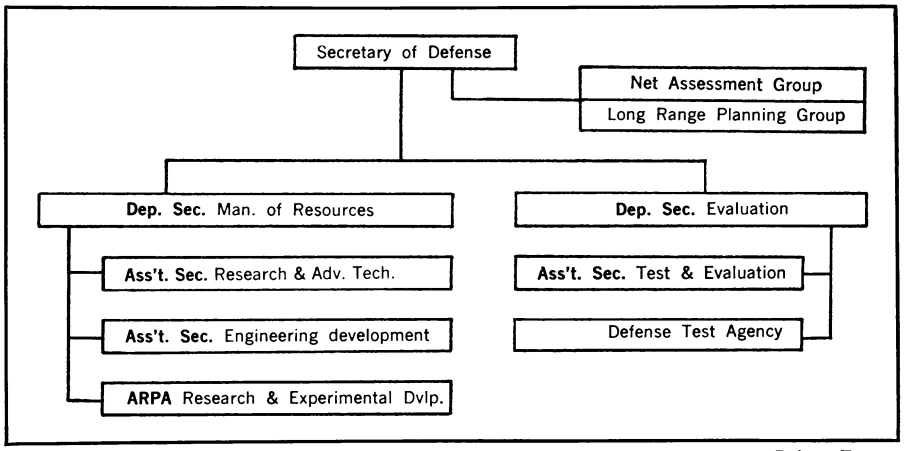
A large new area that the Batavia accelerator will be able to investigate, says Dr. Goldwasser, is the behavior of neutrinos, massless particles involved in nuclear beta decay. Because of the intensity of NAL's proton beam it will be able to produce very copious beams of neutrinos. "Not one neutrino, or two, or a dozen," says Dr. Goldwasser, "but thousands." With this kind of intensity Dr. Goldwasser feels that the interactions of neutrinos with other matter, which are still somewhat mysterious, can be definitively studied.

The most numerous items in the batch of proposals, says Dr. Goldwasser, are suggestions to test theoretical predictions that the cross section, or probability of interaction with some other matter, of a particle and the cross section of its antiparticle should approach the same values at higher energies. At low energies, matter can do some things that antimatter cannot do, so the cross sections of a particle and its antiparticle are different. Theory says that at higher energies the inhibitions should disappear and matter and antimatter should be able to do the same things; the cross sections should therefore come to the same value.

Another prediction made by theorists is that there should be an upper limit to the masses of elementary particles. So far no accelerator has indicated that this limit actually exists, although theorists put it at a particle mass of about 5 GeV. "We are in a position to observe particles above 5 GeV," says Dr. Goldwasser. □

DEFENSE STUDY

Revamping research and development



Robert Trotter

Panel report: New posts, more clout for Defense research and development.

To Pentagon watchers, as the fortunes of the military establishment rise and fall, so vary the emphasis and support given to its research and development programs. And in the past an increase in military expenditures has been related to external pressure—a firm response to a potential or real threat. This was expected.

Today, however, critics in increasing numbers feel that both militarists and their technologists have usurped too much of the nation's wealth. Their emotions have been exacerbated by press reports of "poor performance," "cost overruns," "duplication of effort" and "military waste."

The result has been pressure from within the Administration itself to cut back military spending. Congress, in contrast to its former rubber-stamp approach, is questioning nearly all new military R&D programs and taking a harder look at many ongoing sacred cows.

Last year, the new President faced an austere military budget but foresaw no reductions in United States commitments. In July 1969, he convened a blue-ribbon panel to perform a critical analysis of the Defense Department's organizational structure and management processes. The intent: to improve Defense performance and still effect cost reductions.

The year-long investigation by the Defense panel completed, its chairman, Gilbert W. Fitzhugh, delivered a 237-page report to the President in mid-July, and by the end of the month it was made public.

The report was a shocker. It proposes broad Defense Department reorganization through 113 major recommendations, and calls for sweeping changes in the management of R&D programs.

If Defense Secretary Melvin R. Laird responds positively to this streamlining, the impact on military R&D will be resounding—and, many feel, the nation will be the beneficiary. At present Defense officials are hesitant to comment on the proposed changes, but some do admit privately that the whole system is overdue for such an overhaul.

The key recommendation concerning research and development is the abolition of the position of Director of Defense Research and Engineering, now occupied by Dr. John S. Foster. The position would be replaced by three Assistant Secretaries to direct Research and Advance Technology, Engineering Development, and Test and Evaluation. A new independent Defense Test Agency to monitor all weapons testing would also be established.

A new Net Assessments Group to weigh United States defense capabilities against intelligence reports of potential threats and determine weapon needs prior to procurement approval would be established. Also created would be a Long Range Planning Group.

Fitzhugh, board chairman of Metropolitan Life Insurance Co., says he is not wholly critical of the way the military does things. There are, he asserts, "many things I think they do well." But he also says; "Frankly, we think it's an impossible organization to administer in its present form—just an amorphous lump."

The consensus of some industry and Pentagon officials appears to be that if panel recommendations relating to research, development, test and evaluation are acted upon, these functions will assume a more important role and provide more effective control in the future process of weapons procurement.

A principal argument of the panel is that too many decisions have to be made by the Secretary of Defense and