RESEARCH FACILITIES AND PROGRAMS

Zero Gradient Synchrotron in Operation

The experimental program for the newly completed Zero Gradient Synchrotron at Argonne National Laboratory commenced last month. Construction of the accelerator, which had been in progress since 1959, was completed during the summer, and, on September 18, the machine accelerated its first beam of protons to an energy of 12.7 BeV, exceeding its design energy by 0.2 BeV. After tuning and adjustment, the beam intensity is expected to reach 10^{13} particles per pulse.

Ground was broken for the ZGS on June 27, 1959. Work on the building to house the 200-ft diameter magnet ring commenced in December 1960, and the building was completed in 1961. The first stage of the injection system, a 750-keV Cockcroft-Walton, was completed and operated in November 1961. The second stage, a 110-ft linac which produces a 15 mA beam at an energy of 50 MeV, went into operation in March of this year. The main synchrotron unit was completed in July, and all components of the accelerator were operated for the first time as a unit on August 1.

Construction of the ZGS has been the responsibility of Argonne's Particle Accelerator Division. This division of the Laboratory also works in cooperation with the High Energy Physics Division to design and build equipment for conducting experiments with the synchrotron. Roger Hildebrand is Associate Laboratory Director for High Energy Physics.

John J. Livingood, a senior physicist at Argonne and former director of the Particle Accelerator Division, was responsible for the initial planning and establishment of the Division. Albert V. Crewe was in charge of the synchrotron project from 1958 until he was appointed Laboratory Director in November 1961. He was succeeded as director of the Particle Accelerator Division by Lee C. Teng, who has been responsible for the concept and many design features of the ZGS since he joined Argonne in 1955.

Ronald C. Martin and John P. Fitzpatrick, associate directors of the Particle Accelerator Division, directed scientific and engineering activities of the ZGS project. The design for the magnet ring of the synchrotron was conceived by Martyn H. Foss, former associate director of the Particle Accelerator Division.

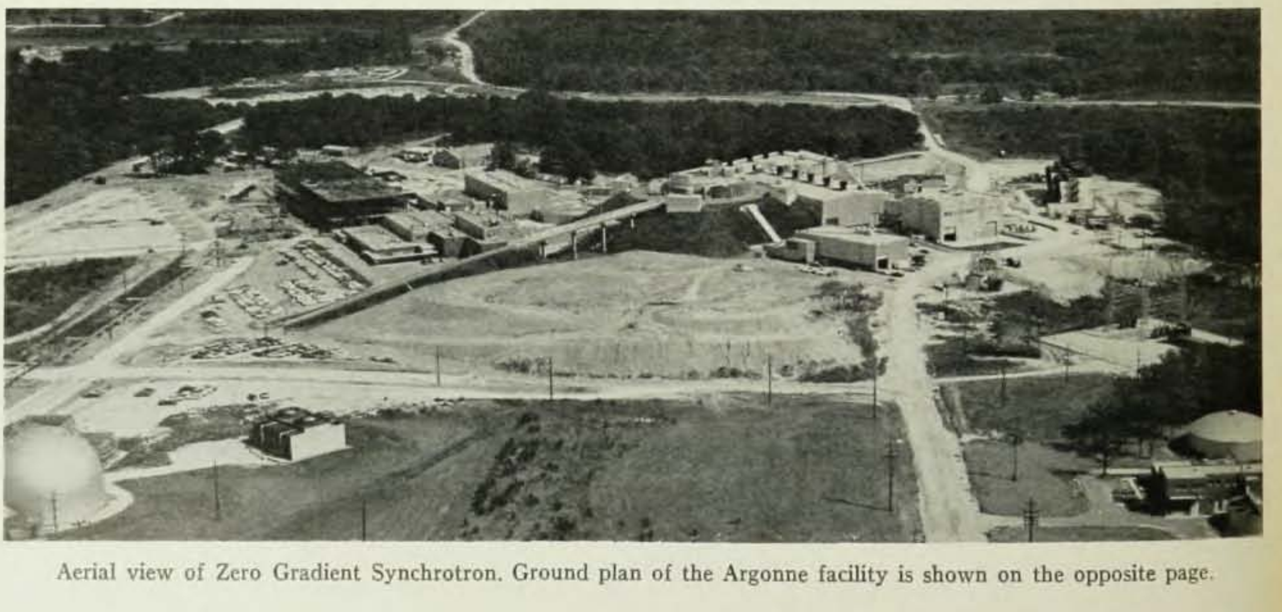
The Accelerator Users Group, composed of high-energy physicists representing Midwestern universities, was organized in December 1958. The group has met regularly over the past five years to hear progress reports on the ZGS, to discuss the state of high-energy research, and to plan experimental programs for the ZGS. After reviewing 19 initial proposals, the group's Program Committee selected six projects for scheduling during the accelerator's first three months of operation:

1. Experiments on the interactions of high-energy neutrinos and antineutrinos (R. A. Lundy, T. B. Novey, D. D. Yovanovitch, Argonne National Laboratory; V. L. Telegdi, University of Chicago).

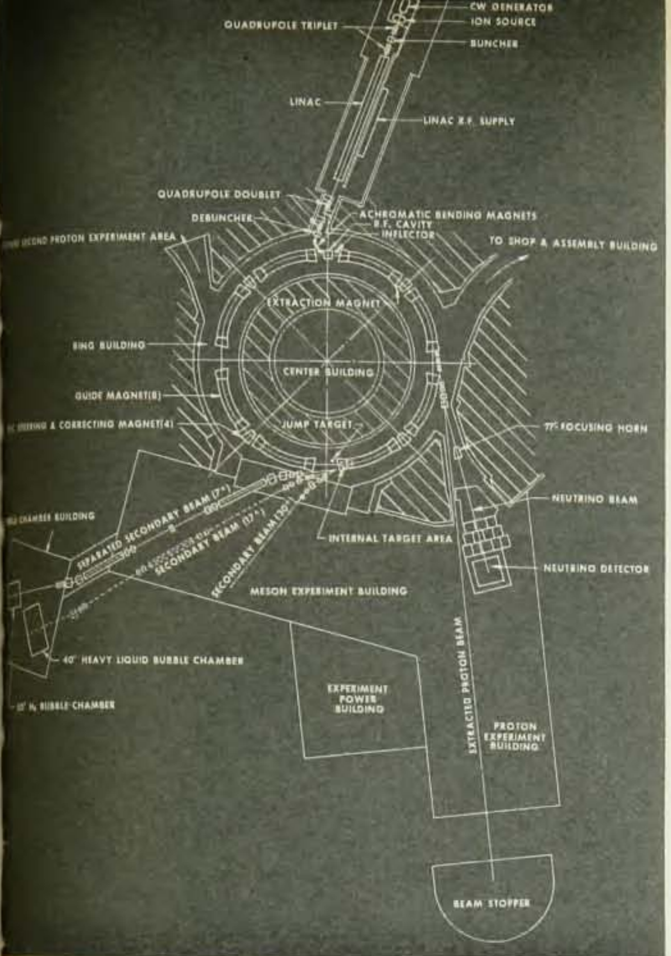
2. $\pi + p$ interactions at 2.75 and 5.5 BeV/c (W. D. Walker, A. R. Erwin, M. A. Thompson, and R. H. March, University of Wisconsin).

3. $\pi + p$ and $K + p$ interactions (T. H. Fields, Northwestern University and Argonne National Laboratory; E. L. Goldwasser, University of Illinois; M. L. Good, University of Wisconsin; U. E. Kruse, University of Illinois; E. M. Lyman, University of Illinois).

4. Search for an excited state in the hyperfragment



Aerial view of Zero Gradient Synchrotron. Ground plan of the Argonne facility is shown on the opposite page.



lambda helium (G. L. Burleson, David Cohen, L. G. Hyman, R. C. Lamb, R. A. Schluter, Argonne National Laboratory).

5. Study of the polarization of μ mesons and tests of time-reversal invariance in $K_2{}^\circ \rightarrow \pi^\pm + \mu^\pm + \nu$ (A. Abashian, B. Nefkens, J. H. Smith, A. Wattenberg, University of Illinois).

6. $\pi^+ + d \rightarrow p + p$ (C. T. Coffin, L. W. Jones, M. J. Longo, D. I. Meyer, O. E. Overseth, K. M. Terwilliger, University of Michigan).

Members of the Users Group Program Committee are W. F. Fry and M. L. Good, University of Wisconsin; J. E. Jackson, University of Illinois; D. I. Meyer, University of Michigan; J. J. Sakurai, University of Chicago; and R. A. Schluter, Argonne and Northwestern University. Dr. Hildebrand and Dr. Teng are ex-officio members of the committee.

NBS Standard Signal Broadcasting Stations

An increasing need for greater precision in broadcasting standard time and frequency signals has led the National Bureau of Standards to construct new transmitting facilities for standard broadcast stations WWVB and WWVL at Ft. Collins, Colo.

Operated by the NBS Boulder Laboratories, the new low-frequency stations transmit standard frequencies whose higher degree of accuracy is better suited to satellite and missile tracking programs and basic research on atmospheric and ionospheric phenomena than those of NBS high-frequency stations WWV and WWVH. The latter two stations will continue to be used but will be complemented by WWVB which broadcasts at 60 kc from Boulder and WWVL which broadcasts at 20 kc from Sunset, Colo. Low-frequency transmissions are monitored by a phase-lock system which automatically synchronizes the signals of the Ft. Collins stations with the US Frequency Standard at the Boulder Labs.

WWVB, which provides more stable coverage at distances up to 2000 miles than WWVL, is designed to serve the continental United States. WWVB is intended to serve the Air Force, the US Geological Survey, geophysical and seismic laboratories, missile ranges, and high-precision frequency-calibration laboratories. The 20 kc signal of WWVL provides intercontinental reception particularly important to the National Aeronautics and Space Administration, which partially supported construction costs of this station.

The antenna array for each station consists of four guyed steel towers, 1900 feet long and 750 feet wide. Counterbalances are arranged at the inside and base of each tower to maintain proper tension at the top of the tower and to compensate evenly for Rocky Mountain winds. A transmitter building is located between the two antennas, and a helix house for resonance tuning terminates each antenna.

The dedication of the new stations was held on August 13 at Boulder during the symposium on the ionospheric propagation of very-low-frequency radio waves sponsored by the NBS Central Radio Propagation Laboratory.

Dallas Magnetic Observatory

A combined magnetic observatory and laboratory has been completed near Dallas through the cooperation of the Graduate Research Center of the Southwest, the US Coast and Geodetic Survey, and Texas Instruments Incorporated. The installation is located about 15 miles north of downtown Dallas at latitude 32° 58′ 55″ North and longitude 96° 45′ 00″ West on land provided by the Graduate Research Center. The site was chosen after magnetic surveys revealed that man-made magnetic noise intensity was less than that of natural fluctuations, and that 60-cycle magnetic fields generated by ground currents were less than 1 gamma (10^{-5} gauss). Field inhomogeneities were less than 0.1 gamma/foot. Since the location is part of GRC's 1400-acre campus, its environs can be kept free of ferromagnetic material indefinitely.

The observatory portion of the facility consists of three small buildings designed and located according to the specifications of the Coast and Geodetic Survey. The first of these buildings houses the variometers used to measure changes in the components of the earth's field. Two smaller buildings contain the equipment needed to furnish an absolute calibration reference for the variometer base lines.

The laboratory area, located 216 feet from the