

The geodesic dome topping the bubble chamber control building at NAL has recently been completed ; the photograph shows one of the last panels swinging into place. As reported before (vol. 11, page 102) these panels are constructed from discarded beverage cans bonded between layers of strong plastic following an idea by a NAL materials specialist. About 120 000 cans are now built into the roof.

(Photo USAEC)

storage ring projects. To recall its major features (for fuller descriptions see vol. 8, p. 289 and vol. 9, p. 145) : There will be two 'rings' one on top of the other, of oval shape (120 m and 60 m across) merging in two long straight sections where the beams can be collided at a crossing angle of 24 mrad. Most components are being designed for 4.5 GeV but r.f. power will be installed initially to cope with two 300 mA beams with an energy of 3.5 GeV. Electrons and positrons can be fed to DORIS direct from the new 400 MeV linac or at energies up to 2 GeV having passed via the synchrotron. A luminosity of $10^{32} \text{ cm}^{-2} \text{ s}^{-1}$ is eventually hoped for.

The outer structure of the buildings was completed last summer. The tunnels are already equipped with the cooling water pipes and the main cabling is being done this month. Support plates for the magnets are in position and the first production bending magnet was completed on 28 January. Previously, prototypes of the bending magnets, quadrupoles and of the difficult large aperture double quadrupole, which is one of the components producing the low beta section where the beams cross, had been built and measured. All the magnets are now ordered together with 26 power supply units and they should be completed by August 1973. Initially, however, although a full set of correction coils is being built into each magnet, power supplies for only half of the coils will be purchased.

Prototypes for the r.f. system were also constructed and six 250 kW units have been ordered. Vacuum chambers for the quadrupoles are also ordered and the rest of the chambers will be ordered next month. There has been a change in their design for the bending magnets. Instead of requiring a large bulbous projection protruding from the magnet gap in order to ensure sufficient pumping speed along

the length of the chamber, there will be distributed ion pumps in the bending magnet field on one side of the chamber. On the other side, along two thirds of the bending length, will be a copper absorber for synchrotron radiation. The required pressures are 10^{-9} torr without the beams and 2×10^{-8} torr with the beams.

Beam measurement prototype units are being developed. One unusual instrument is a mode-locked laser giving pulses 10 ps long gating a Kerr cell (the bunches will be about 100 ps long). The technique was tested at the synchrotron at the beginning of February. The beam observation systems will be linked to a control computer which will have a very important role in the operation of the storage rings.

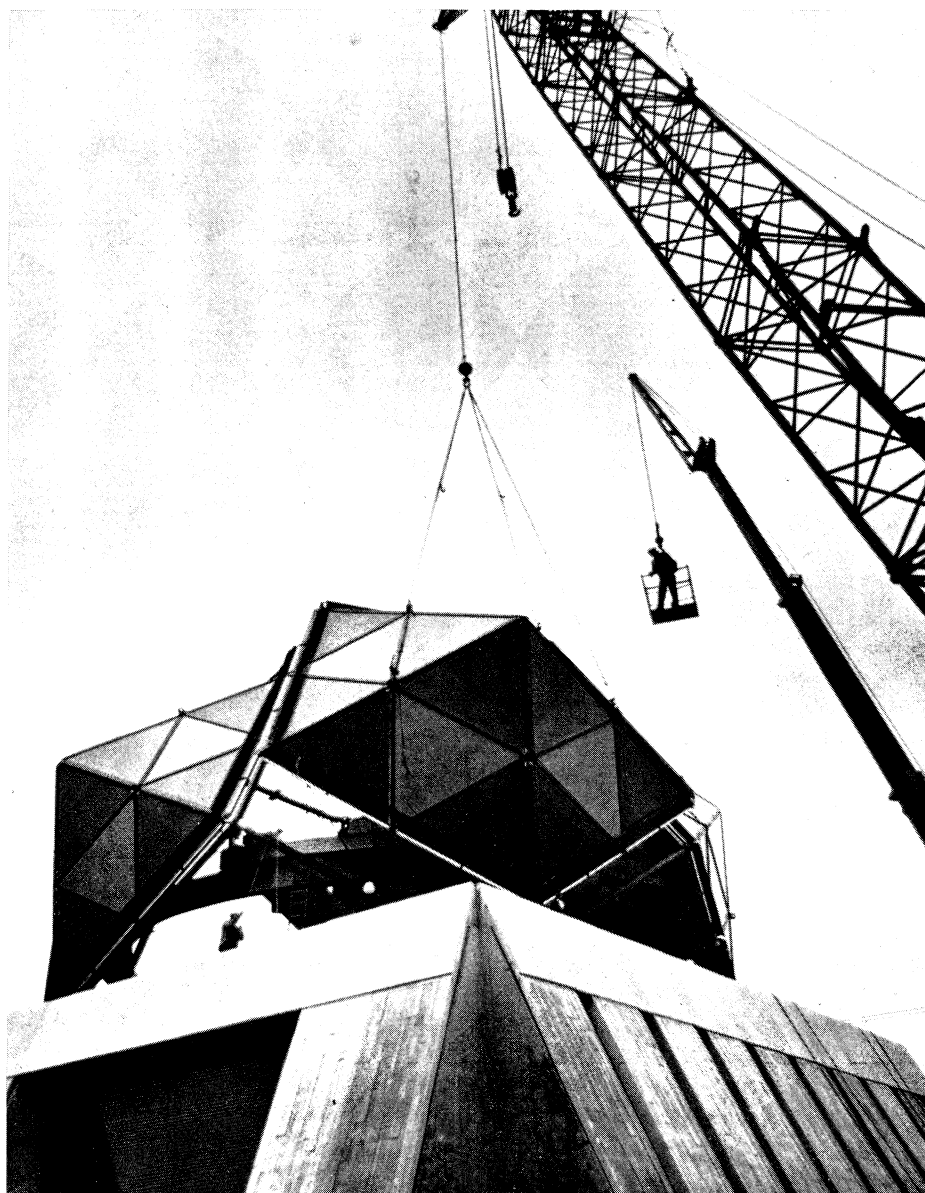
In preparation for the experimental programme one magnet detector system has already been produced. This is the superconducting magnet, known as PLUTO, which has an internal

diameter of 1.4 m, 1.15 m long, and a field of 2.2 T (described in vol. 10, page 231). It was initially intended as a prototype for a bigger version but this is now unlikely to be built and other magnet detector systems are being studied for construction later. If all goes to schedule, commissioning of DORIS will begin at the end of 1973.

GESSS meetings

In January and February there were further meetings of the Group for European Superconducting Synchrotron Studies — a full GESSS meeting at Karlsruhe on 18 January and a Machine Design meeting in the first week of February at CERN.

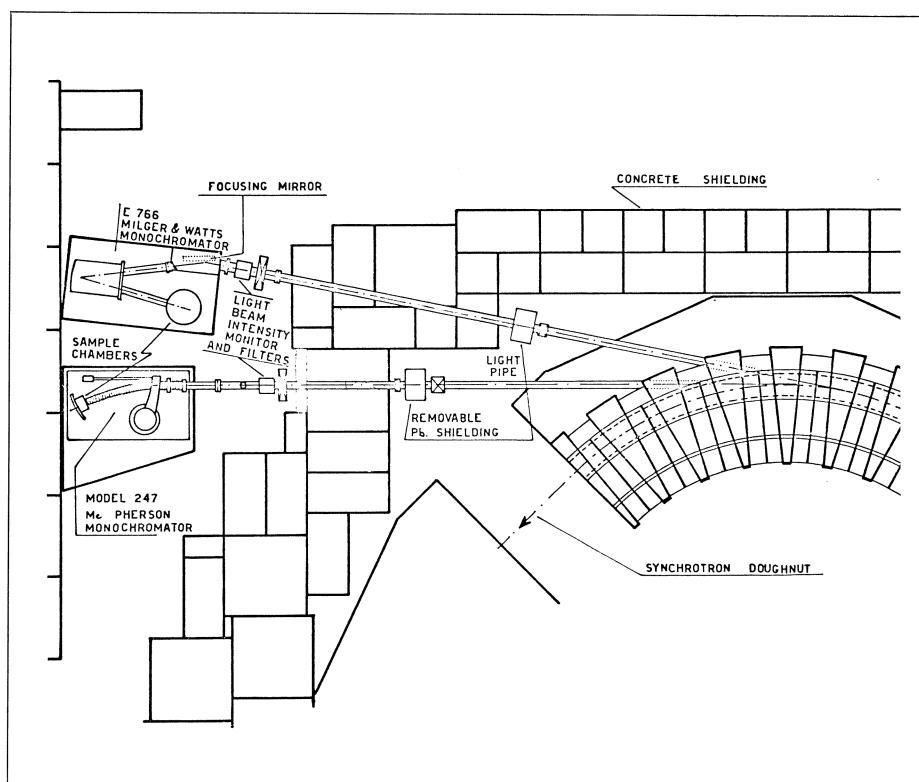
The first brought together specialists from the three European Laboratories collaborating in this field



1. Diagram of the Frascati synchrotron radiation facility. On the right is the ring of the 1.1 GeV machine and emerging tangentially from the beam paths are two light pipes feeding several experiments. Synchrotron radiation facilities are attracting a lot of scientific interest. Daresbury are bringing a major unit into action at the 5 GeV NINA and DESY, with many years of experience with a facility at the 7.5 GeV machine, are to extend their facilities considerably. (We shall report on the work at both these other Laboratories in a coming issue.)

(Karlsruhe, Rutherford and Saclay) and representatives of CERN Laboratory II. Laboratory II is committed to assessing the possibility of incorporating superconducting magnets into the SPS machine lattice. For this reason only half a ring's worth of conventional magnets is being ordered initially and the decision to go superconducting or to continue conventional will be taken in about two years' time. All three collaborating Laboratories are attempting to produce pulsed superconducting magnets appropriate for a synchrotron and thoroughly tested by that time (each using different approaches on some aspects of the magnet design). Magnet specifications for the models being built in each Laboratory will be available soon and we will give more information when they are available.

The second meeting tackled more specifically the integration of superconducting magnets into a synchrotron. It is worth bringing out here that, although the beginning of 1974 is an extremely important decision date for superconducting magnets, a negative decision at that time would certainly not be the end of the road for such magnets. For example, in 1975 there will be decisions on magnets for the beam transport systems to take the highest energy beams from the SPS into the new North experimental area. Later on, more speculatively depending upon the sustained interest of the physics and a more buoyant financial situation, there will be decisions on improvements or conversion of the ISR and even of the further development of the SPS itself. The present work of GESSS, quite apart from its general importance in increasing our mastery of the phenomenon of superconductivity, is necessary to feed vital information into the balance pans for the time when all these decisions are taken.



1.

FRASCATI Synchrotron radiation facility and experimental results

The radiation emitted by the electrons orbiting the 1.1 GeV electron synchrotron at the Frascati National Laboratory has been used for several years for research in molecular and solid state physics. This radiation is much more useful than conventional laboratory sources because of its strong intensity in the 5 to 2000 Å range and its high degree of polarization (about 70 %).

The problems which can be investigated in solid state physics change according to the spectral range of the synchrotron radiation. At small photon energies (below 40 eV) deep valence states are excited and therefore the optical spectra can be interpreted in terms of the conduction band density of states and/or of electron-hole interaction. At higher energies core states are excited and atom-like phenomena take place.

The experimental set up of the 'Solidi Roma' group is shown schematically in the figure. Using a grazing incidence monochromator and a near normal incidence monochromator, the 5 to 2000 Å range is covered with an energy resolution better than one in a thousand and also two experiments

can be performed at the same time. The optical properties of layer structures, such as graphite and GaSe, are presently under investigation. The components of the dielectric tensor are obtained from the reflection and transmission spectra and it will be therefore possible to verify the validity of the two-dimensional model used in the band structure calculations.

Another problem of interest is the identification of the structures present in the high energy absorption thresholds of alkali halides. Better insight can be achieved under uniaxial stresses, which split degenerate levels. Such splittings are hardly detectable with absolute measurements and require either stress or wavelength modulation techniques.

The extreme ultraviolet region of the spectrum is also being used by a second group for atomic and molecular spectroscopy in high magnetic fields. In particular, spectral structures due to magnetic quantum levels in transitions from inner shells are being studied in the absorption spectra of various semi-conductors.

In order to achieve the high sensitivity necessary for performing such experiments (signals more than 70 db below the noise level must be recovered) techniques of modulation spectroscopy and phase detection are to be used. In particular, it will be necessary to achieve modulation of the applied magnetic field, which will