

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCEGOVERNING BOARD

## Progress at the Rutherford Laboratory

Note by T. G. Pickavance

Proton Linear Accelerator

The full energy of 50 MeV is now in regular use on a new schedule, with the machine operating 24 hours for 18 days of a 28 day period. The remaining 10 days are used for maintenance and improvement of the machine and the experimental apparatus. 71% of scheduled running time has been obtained during February, and has been used by two groups from Oxford University, two from London, 2 N.I.R.N.S. groups, and A.E.R.E. An unusual experiment was the bombardment of solar cells and other equipment concerned with communication satellites, for R.A.E. Farnborough, to simulate the damage which could be caused by protons in the Van Allen belts.

The research programme has been reviewed to ensure that the machine time will be devoted to the most suitable experiments; the known demands in this programme will use up all the available beam time for a year. 61 graduates are now using the accelerator.

Nimrod

Studies of injector performance have been concentrated on the reliability of pulsing; secondary electron emission (multipactor effect) had been preventing reliable radiofrequency build-up. A coating of lamp black on the drift tubes was found to cure this trouble completely, but lowered the peak electric field by causing sparking. After prolonged operation the spark-limited radiofrequency field has increased to the point where a beam is now produced again. It is hoped that systematic beam transmission studies may be started soon. The ion source has produced a total current of 50-100 milliamperes for short periods, but the highest reliable current achieved so far in the necessary long pulses is 30-40 milliamperes; this is quite satisfactory, but attempts will be made to improve it.

The motor alternator at the Rutherford Laboratory has been passed as safe for pulsed operation, and pulsing tests began late in January as part of the commissioning programme of the magnet and its power supplies. Four of the eight magnet sectors have been coupled together and energised as a unit, using the single alternator and half of the 96 Brown Boveri rectifiers. It is, therefore, possible to run half of the magnet on full power; pole pieces were installed in this half of the magnet. The tests have gone better than was expected; the design full load for 7 GeV (9,150 amperes magnet current) was achieved on 16th February. Shortly afterwards the 15% over-current called for in the specifications of the machines and the rectifiers was achieved, and the magnet has since been pulsed frequently at 10,000 amperes. The full repetition rate (28 pulses per minute) has been achieved at normal full power, and the reduced rate of rise of magnetic field has been found to occur at the point required for satisfactory injection of particles. Rather few magnetic measurements can be made at this stage, because the pulse programme is determined by the commissioning needs of the alternator and rectifier equipment. This commissioning is going very well, however, and it has been verified that fields of over



16,000 gauss (corresponding to more than 8 GeV) can be produced. The magnet operates quietly and with no unexpected movements.

Production of pole pieces is no longer a problem, and the pole-face windings are also arriving from the manufacturers in good time.

The first production outer vacuum vessel was delivered to the Laboratory early in February, after having been delayed by accidental damage at the factory. The damage was satisfactorily repaired, using techniques which have been developed during the last six months in a cooperation between the contractor, consultants on epoxy resins, and the Rutherford Laboratory. Eight days after delivery the vessel was ready for pumping on its test rig, and two days later was passed as suitable for incorporation in the machine. The time allowed for these operations in the programme is more than three months per vessel, including the time taken to repair leaks. No repairs were necessary on this vessel. We cannot expect this success to be repeated every time, particularly with the inner and header vessels which have much more stringent vacuum requirements and, even if perfect, will need to be pumped for long periods before their perfection can be verified. Nevertheless this result is very gratifying; it represents a real saving of time, and confirms our belief that the quality of the manufactured material has now reached a very high level.

#### Buildings

Work has been started on the three-storey office and laboratory block by Beecham's Buildings Ltd.; it is going very quickly and in a most business-like manner. Further portions of the R.1 extension have been occupied, and some former offices in the original R.1 building are being converted into light laboratories.

#### Auxiliary apparatus

The magnet of the liquid hydrogen bubble chamber has been shipped to Geneva by the University group. There have been delays in completion of the chamber itself; final tests are not now expected to be completed before the late summer or autumn of 1962. The group can be accommodated for this longer period, however, and neither the C.E.R.N. nor the Rutherford Laboratory programmes are adversely affected.

Experiments have started on the construction of beam channels through the main shielding wall, using moveable stacks of steel plate.

A prototype particle separator tank, with crossed electric and magnetic fields and designed to operate at  $\pm 600$  kilovolts, is being used to test component parts which are being developed for production models.

The external proton beam programme has been placed in jeopardy by what appears to be neglect on the part of the manufacturer of the plunging mechanism. The Authority's Inspectorate have the matter in hand.

The second phase of the beam-handling programme is now being specified; many of the components can be obtained by extensions of contracts already placed for the first scheme.

#### General

We are attempting to extend the training potentiality of the Laboratory to fields outside nuclear physics; in preliminary discussions universities have expressed great interest, especially in engineering.