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NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

GOVERNING BOARD

Progress at the Rutherford Laboratory

Note by T. G. Pickavance

Proton Linear Accelerator

The steady improvement in machine operation is illustrated by the following figures for available machine time, for three periods of 7 months:

20 April - 13 November 1960	980 hours
27 February - 28 September 1961	1169 hours
1 January - 23 July 1962	2835 hours

During the last three months the percentages of scheduled time operated have been 66%, 68% and 84%.

A five week shut-down has just been concluded. Two adjustable quadrupoles were installed in Tank 3 to permit precise control of the direction and position of the proton beam. An improved RF level monitoring system and an intertank phase monitoring system were also installed, to improve the energy stability of the beam.

The proton-proton polarisation experiments mentioned in the last report have been repeated at 30 MeV. Four papers were presented at the Padua Conference in September by teams working on the P.L.A., and eleven at the Physical Society Conference at Harwell.

Two research students (from Oxford and King's College, London) have been awarded doctorates as a result of experimental work on the P.L.A.

In research on superconducting RF resonators half the theoretical surface conductivity has been achieved, i.e., an improvement by a factor greater than 10^4 over copper at room temperature.

Nimrod

The injector has operated at currents up to 10 milliamperes, without the prebuncher. The prebuncher has been assembled and tested, and is satisfactory, but has not yet been installed on the machine. Experiments on electron bombardment of copper surfaces, in connection with the multipactor troubles previously reported, have shown that oil vapour in the system markedly reduces secondary electron emission.

The engineered version of the radiofrequency drive chain has been delivered and installed, and has been made to work satisfactorily after modification and some rewiring. The contractor's workmanship was very bad.

Magnetic survey measurements have been completed, and although some of the detailed information is still being computed it is already clear that the results are generally satisfactory. The surface of magnetic symmetry is within 0.1 inch of the geometric median plane, the average remanent magnetic field is 9 gauss, and the variations from this average in different octants of the machine are satisfactorily small. Errors in the gradient of the magnetic field are well within the range of correction available. It is evident from the results of the survey that the elaborate randomising process, carried out during manufacture and installation of the magnet, was necessary and has succeeded in its object.

During the early part of the magnetic field survey it was found that the power supply failed to function properly in certain conditions of unbalance in the capacitance of the load, and also failed to give the proper slope control at high magnetic fields for the long spill-out times which will be required in many experiments. Both these difficulties have now been overcome, and the power supply has been pulsed for more than 500 hours. The second alternator, which had to be fitted with new poles at the contractor's works, was delivered in September and is being installed.

All eight outer vacuum vessels have been delivered, and seven have been installed in the Nimrod magnet. Six of the eight inner vessels have been manufactured; one of them, on test at the Laboratory, achieved an ultimate pressure of 6.10^{-7} mm of mercury and a leak rate of 0.08 lusec. Both figures are much better than the minimum acceptable values, and all vessels received so far have been well up to standard after repairs in the laboratory.

The completion date of September 1963 still stands, and all the setbacks which have occurred so far have been accommodated within the programme.

Auxiliary apparatus

A fast measuring machine for bubble chamber photographs, to be used "on-line" with the Orion computer, is being developed in collaboration with C.E.R.N. Two smaller manual machines, of a type developed by University College, London, have been ordered for use with spark chamber photographs.

Delays on the Orion computer are causing financial difficulty; we are having to buy time on the 7090 computers owned by the Authority and the C.E.G.B. Financial difficulty has also been caused by tenders for the helium liquefier needed for the liquid helium bubble chamber; the quotations are twice as high as the estimates made by firms when the project was approved. The firms are in the U.S.A. and on the Continent, as well as in this country.

General

Seven Soviet physicists visited the Laboratory in October, in connection with the programme arranged between the Authority and the U.S.S.R.

A new engineering group has been set up, to support the high energy research teams using Nimrod. This follows the pattern established by experience on the P.L.A. Changes have been made to the engineering organisation in order to free experienced engineers for this new group, the most important being to disband the supply group whose functions have been taken over by the central engineering group.

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