

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCEGENERAL PURPOSES COMMITTEEA Broad Range Magnetic Spectrograph for the P.L.A.

Note by T. G. Pickavance

1. In February 1959 a proposal was made by Manchester University that a broad range analysing magnet of the Buechner type should be built for use with the proton linear accelerator. Since the proposal would involve substantial expenditure it was widely discussed with the users of the accelerator and in November 1960 was submitted to the Visiting Committee, who endorsed it and recommended a design study. The design work has now been completed by the North West Machine Design Co. Ltd., in collaboration with Dr. A. Jaffe of Manchester University and members of our P.L.A. Group.
2. The object of the spectrograph is to investigate the energy spectra of charged particles emanating from nuclear reactions, at several angles of emission simultaneously. Experiments of this type are an important part of the P.L.A. research programme and are of interest to many visiting groups including Manchester University. The particles are analysed in energy in the several gaps of a special magnet, and are observed by means of nuclear emulsions which are subsequently examined under a microscope. This method has the advantage of economy in machine running time since the emulsions are examined after a run. It lends itself well to the needs of universities since the emulsions can be taken away for examination. The spectrograph would be a permanent addition to the facilities available for general use on the P.L.A.
3. The Committee have already approved the construction of a single channel spectrograph for the P.L.A. at an estimated cost of £30,000 (NI/GP/61/27). This is a different instrument for a different purpose. The single channel spectrograph has a greater sensitivity and can therefore be used on weaker beams. In particular it will be most valuable in experiments with the polarised beam of the P.L.A. On the other hand it will have a poorer resolution than the broad-range spectrograph and the latter would therefore be able to perform more precise and detailed experiments. The broad range facility, with the multiple magnet gaps, would also enable much more data to be accumulated in a given time. The two instruments would therefore be complementary. Both have been considered and supported by the Visiting Committee.
4. The magnet would have eleven gaps and could cover an energy range of 2 to 1 at one setting of the magnetic field, and an angular range of 40° in any one run. The total angular range would be $\pm 156^\circ$, and the maximum energy 45 MeV for protons. The whole instrument would weigh 80 tons and would be assembled on a Bofors gun mounting for easy rotation and accurate positioning.

Detailed cost estimates have been made by the North West Machine Design Co. and checked by Rutherford Laboratory engineering staff. A

summary of these estimates is:

Items to be manufactured	£40,375
Items to be bought	£ 7,925
Miscellaneous expenditure including testing, transport of major components	£ 3,000
Total	£51,300
Allowance for contingencies	<u>3,700</u>
	£55,000

A full set of drawings is available, and the plan would be to divide the manufacture of the various components between suitable firms rather than to place a contract on one firm for the whole device. The bulk of the expenditure would fall in 1962/3; sufficient funds are available for the rather small expenditure which would be incurred in the current financial year.

5. The approval of the Committee is sought for the manufacture of the broad range spectrograph at an estimated cost not exceeding £55,000.

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